

WST2

Washington State Technology Transfer



2002 Crystal Mouse Winners pg 4

Portable Asphalt Recycler pg 18

2002 Expo pg 25



**Washington State
Department of Transportation**

A Technical Digest of the
Washington State Department of Transportation (WSDOT)
and the Local Technical Assistance Program (LTAP)

Issue 77, Winter 2003

Washington State Technology Transfer

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Editor reserves the right to refuse to publish and to edit articles to conform to the standards of our publication.

The opinions expressed in articles are not necessarily those of the editor.

Cover Photo: *Douglas County's Gravel Road Maintainer gets a thorough going over at the 2002 Pacific Northwest Transportation Technology Expo.*

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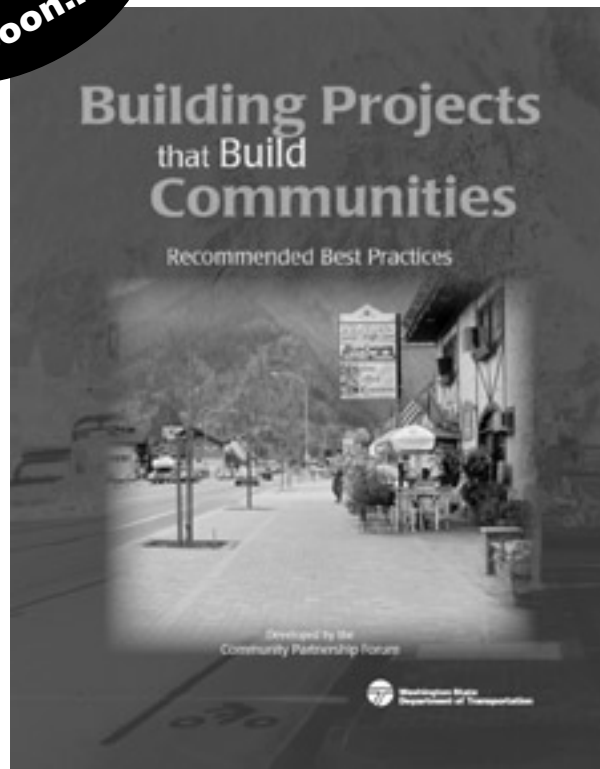
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Developed by the

Community Partnership Forum

**Coming
Soon...**



Real partnerships start with ongoing relationships of trust and collaboration. The concept of true community partnerships is good in theory, but can be difficult to put into practice; not only because of things such as local land use decisions which can enhance or negatively impact the transportation system, but also because it requires tremendous teamwork between agencies and organizations.

Information on:

Using the Community Partnership Approach

Setting the Stage for Success

Working Through Design, Review and Approval

Building Your Project

Evaluating, Adjusting and Improving

Case Studies from WSDOT/Local Agency partnerships in Community-based Transportation Design

Forms and resources for your use

 **Washington State
Department of Transportation**





*Dan Sunde
Technology Transfer Engineer
WST2 Center*

Happy New Year from the WST2 Center! We're looking forward to another great year in 2003. As funding continues to get tighter we will continue to look for ways to cut the cost of transferring information but still improving service, a challenge I know everyone is facing these days. We have begun to migrate to electronic media where it is practical. Although we realize electronic distribution won't fit every situation, we will try to maximize its use. We will make everything we publish available on the web and only distribute hard copies of those items that are impractical to e-mail. This will save a tremendous amount of time, paper and postage. You can expect to see more of our information coming to you via the web and e-mail through our list serves. Therefore, we will be actively promoting and expanding the use of list serves to distribute information to you on various topics. I encourage you to visit the WST2 Homepage and subscribe to the topics that are of interest to you.

As most of you are aware, the WST2 Center has been implementing the "Build a Better Mousetrap" Program now for a couple of years through our newsletter, the WST2, and the Pacific Northwest Transportation Technology Expo in Moses Lake. We have been receiving a lot of inter-

est in and positive feedback on the tools and equipment modifications, or "Mousetraps", from agencies in Washington and around the country. We have also been receiving word that agencies have begun to put the mousetraps to work in their own agencies.

The WSDOT invests a lot of effort in the program and we would like to make sure the effort is paying off. To help measure our effectiveness, we would like to get a handle on how many of the tools and equipment modifications have been duplicated in other agencies and which ones are the "hot" ones. Your response will assist us in planning both the future of the program and the Tech Expo. As your comments come in, I will report back which tools and equipment modifications are the heavy hitters and how broadly the ideas have been spread.

Would you please e-mail me and let us know whether or not your agency has implemented any of the mousetraps?

We would like to find out:

- Which Mousetrap(s) your agency has built (or planning to build)?
- About how many of each?
- Did you modify the design to work better for you?
- Did you take a concept from a mousetrap and build your own version?

We would also appreciate any comments you might have on the Mousetrap Program and/or the Expo. We need to know what you like and what you would like to see improved.

You can pass your comments and mousetrap response to me at: SundeD@wsdot.wa.gov.

Thanks for your participation,



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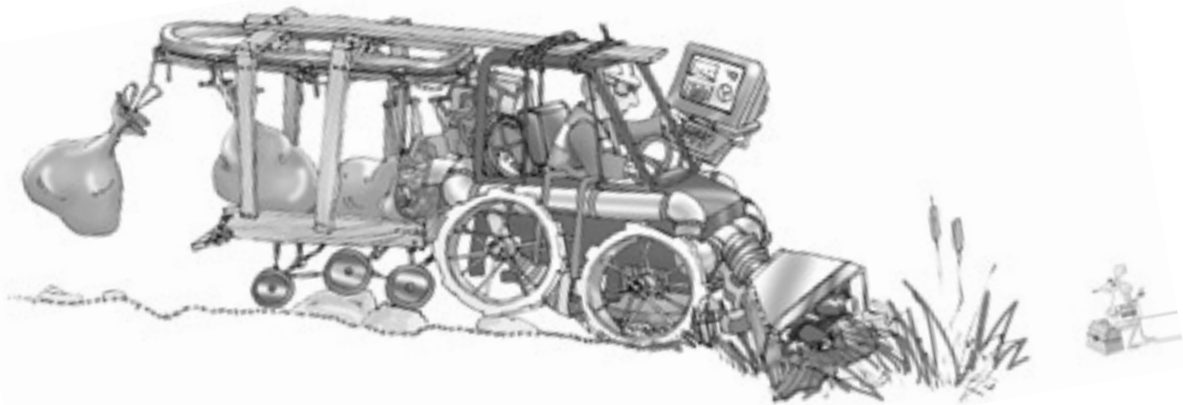
The Local Technical Assistance Program (LTAP) is a national program financed by the Federal Highway Administration (FHWA) and individual state transportation departments. Administered through Technology Transfer (T2) Centers in each state, LTAP bridges the gap between research and practice by translating state-of-the-art technology into practical application for use by local agency transportation personnel.

Any opinions, findings, conclusions or recommendations presented in this newsletter are those of the authors and do not necessarily reflect the views of WSDOT or FHWA. All references to proprietary items in this publication are not endorsements of any company or product.

 **Washington State
Department of Transportation**

 **U. S. Department of Transportation
Federal Highway Administration**

Congratulations to the 2002 Crystal Mouse Award Winners!



By Dan Sunde, Technology Transfer Engineer, WST2 Center

WSDOT's WST2 Center announce the winners of the 2002 Crystal Mouse Awards. Each year the WST2 Advisory Committee selects the best idea published in the WST2, the WST2 Center's newsletter, and the attendees at the Pacific Northwest Transportation Technology Expo vote for the best of show in two categories: hand tools and equipment. This year the WST2 Advisory Committee selected the WSDOT Southwest Region's Under Guardrail Cleaner invented by Jack Moltz and Daryl Sprague in the WSDOT Chehalis Maintenance Shop. The selection was based on five criteria:

1. Safety

2. Cost Savings

3. Inventiveness

4. Transportability

5. Effectiveness

The city of Oak Harbor's Jack Hammer Storage Unit, invented by Keith Jameson, received the most votes at the 2002 Tech Expo for the best tool. Douglas County took the honors for the best equipment with the Gravel Road Maintainer invented by the team of Ken Willms, Dave Mires, Robert Mires, Dell Mires and Lyle Eggers.

Congratulations to the winners for their initiative and creative thinking in reducing cost, increasing safety and improving efficiency!

"Thank you" to all of you that par-

ticipated in the Pacific Northwest Transportation Technology Expo and the Build a Better Mousetrap program in 2002.

If you haven't submitted your mousetrap for publication in the WST2, please do so. It will help us get the word out so others can reap the benefits of your invention and give us a chance to acknowledge you for your idea.

Just fill out the application form enclosed in the newsletter and include as many photos as possible (please include photos of the inventors and fabricators too) and sketches with dimensions, then mail it to us at:

*Build a Better Mousetrap
c/o Dan Sunde
WST2 Center-WSDOT
P.O. Box 47390
Olympia WA, 98504-7390*

The Best Tool for 2002 - Keith Jameson's Jackhammer Storage Unit

*Inventor & Fabricator: Keith Jameson
Supervisor: Ed McNeill*

The Jackhammer Storage Unit stores a jackhammer vertically on a steel peg mounted on a hinged plate inside a truck's utility box. The base plate is mounted on the bottom of the storage compartment and is piano hinged to allow the peg to rotate outward for easy access. With the unit mounted at waist height, these features combine to allow quick and safe storage and retrieval of the heavy tool.

A similar hinged plate assembly is mounted behind the jackhammer storage hinge assembly with several pegs to store the various bits used.

Keith reports the tools are better organized and there is far less chance of back injury in accessing and storing the jackhammer.



Best Equipment for 2002 - Douglas County's Gravel Road Maintainer

*Inventors & Fabricators: Ken Willms,
Dave Mires, Robert Mires, Dell Mires
and Lyle Eggers
Supervisor: Ken Willms*

The Gravel Road Maintainer is a mini-grader that is towed behind a pickup truck. All adjustments of the blade are hydraulically controlled inside the pickup. The Gravel Road Maintainer greatly improves efficiency and quality of work in maintaining unsurfaced roads. This sophisticated piece of equipment was designed and built by an ingenious team made up of Ken Willms, Dave Mires, Robert Mires, Dell Mires, and Lyle Eggers.



Best Mousetrap
Published in 2002 -
Jack Moltz and Daryl
Sprague's

Under Guardrail Cleaner

*Inventors: Jack Moltz & Daryl
Sprague*

Fabricator: Bob Steel

Supervisor: Larry Stritmatter

Superintendent: Paul Simonsen

The Under Guardrail Cleaner is an A-frame shaped blade that mounts to the bucket of a Cat mini-excavator. The Cleaner fits between the guardrail posts and allows the debris that has collected under the guardrail to be swept away for removal and reshaping the shoulder. The Cleaner has reduced the cleaning crew from 8 to 3, allowed daytime operations which couldn't be used before due to lane closures,



replaced a lane closure with a shoulder closure, and increased the rate of cleaning from 1,000 feet per day to over 5,300 feet per day.

The Under Guardrail Cleaner has saved time, improved traffic flow, reduced crew exposure to traffic, and cut costs. ▲

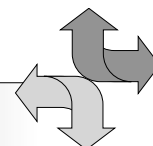
Adoption of the Manual on Uniform Traffic Control Devices (MUTCD)

The MUTCD 2000 was published in the Federal Register on December 18, 2000, with the effective date of January 17, 2001. Per Title 23 CFR 655.603 (b), changes to the national MUTCD issued by the FHWA were required to be adopted by the States and other Federal agencies by January 17, 2003.

Other compliance dates are given for specific new provisions in order to allow additional time for compliance.

The national MUTCD can be found at <http://mutcd.fhwa.dot.gov/>

Manual on Uniform Traffic
Control Devices (MUTCD)



Welcome, Richard Swan

The WST2 Center welcomes Richard A. Swan to the WST2 Advisory Committee! Richard has served on the Colville Tribal Business Council for eleven years. During his tenure he has worked the transportation aspects of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21) for the Colville Tribes. He has worked diligently with the Tribal LTAP centers and is excited about serving on the WST2 Advisory Committee. Richard points out, "The progress of Transportation Technology can best serve the population of Washington State through the T2 Centers and their respective training programs. A good road is a safe road." ▲



Will Kinne Says Farewell to the WST2 Advisory Committee



The WST2 Center says farewell to another great Advisory Committee

member. After a 31-year career with Pierce County and serving on the WST2 Advisory Committee for over 8 years, Will Kinne, Maintenance Manager for Pierce County, announced his retirement and resigned from the WST2 Advisory Committee.

Will worked for Pierce County Public Works and Utilities, Transportation Services for over 30 years, the last six years as Operations Manager, overseeing a staff of 200 and a \$21 million annual budget. A few of Will's noteworthy accomplishments as Operations Manager include development of a comprehensive divisional training program and a very successful infrastructure inventory

system, including environmental requirements utilizing GIS/GPS technology.

For the past eight years Will has been a valuable asset to the Local Technical Assistance Program. He has provided a tremendous amount of input and support to the WST2 Center, and has been a very active participant, providing insightful and informative articles for the WST2 newsletter and sharing his practical experience and visionary ideas. We will miss his participation and support greatly.

We in the WST2 Center wish Will the very best in his retirement and future endeavors. ▲

WST2 Center Road and Street Management Program Update

*By Bob Brooks, WST2 Pavement
Technology Engineer*

The WST2 Center's Road and Street Management Program is structured around the training matrix finalized in April 2001 by the Training Committee of the NorthWest Pavement Management Association (NWPMA). The Training Committee, chaired by Mr. Bill Whitcomb, put considerable effort into identifying and prioritizing training topics that provide a set of technical skills of critical importance to the association members in the performance of their job duties and as a foundation for career advancement.

The Road and Street Management Program (RSMP) utilizes the highest priority training topics identified by the committee in the development of a core set of courses that provide the necessary technical skills needed by today's pavement managers. In addition, non-technical courses that provide important career advancement skills are also included in the program.

The RSMP is designed around two sets of training courses: a group of ten required courses that provide the needed technical skills and a group of seven suggested elective courses that allow for more specialized training in an area of one's choice. Other elective courses will be considered as well. It is anticipated that a student will complete the core set of courses and at least 1 elective. When the courses are completed, the student will earn a Certificate of Achievement (CA)

in Road and Street Management. Courses do not need to be taken in any particular order, so a student can join the program at any point. It is expected that 3 or 4 required courses will be offered each year, several may be offered as pre-conference workshops at the Fall and Spring NWPMA conferences. It is anticipated that students will be able to complete the program and earn a Certificate in 2 to 3 years.

Road and Street Management Program - Technical Core Requirements:

1. Concepts of Pavement Management
2. Pavement Condition Rating Training
3. Preventive Maintenance Treatments
4. Fundamentals of Concrete Pavement Design
5. Fundamentals of Asphalt Pavement Design
6. Fundamentals of Pavement Construction
7. Fundamentals of Roadway Construction Materials
8. Effective Presentation Skills
9. Effective Writing Skills
10. Principles of Supervision

Road and Street Management Program - Suggested Electives (Partial List):

1. Technical Math
2. Design and Maintenance of Gravel Roads
3. Integrating GIS and GPS Into Pavement Management
4. Environmental Concerns for Pavement Managers
5. Introduction to Finances for Pavement Managers
6. Asset Management
7. Highway Drainage

Credit will be given to students for courses completed since January 1, 2000. This is when the WST2 Center automated its student and course record keeping system. The courses that qualify under the program have been identified and will be flagged in the system to insure proper credit is given. Following is a listing of RSMP required courses that have been offered since January 2000:

**Washington State
Department of Transportation**

CD Library

\$10

**2 full years of manuals
updated every 6 months**

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50+ Manuals

Standard WSDOT forms

Access to WSDOT and LAG “intelligent” forms

Contact Stephanie Williams
WSDOT Engineering
WilliSr@wsdot.wa.gov
(360) 705-7430



**Calendar Year 2000
Course Offerings:**

- Pavement Condition Rating Workshop
- Introduction to Pavement Management

**Calendar Year 2001
Course Offerings:**

- Techniques for Pavement Rehabilitation
- Pavement Condition Rating Workshop

**Calendar Year 2002
Course Offerings:**

- Design and Construction of Concrete Pavements
- Pavement Condition Rating Workshop
- Basic Supervisory Skills

We would like to encourage all the local agencies to lend their support to this program. This program offers benefits to both the student and the employer. By completing the program, the student demonstrates his or her commitment to improving job performance, both technical and non-technical, and they acquire a well-rounded skill set to better serve the agency and the public.



Air-fed Deer Whistles Scientifically Tested

By Janice Palmer, Office of University Communications, University of Connecticut. Reprinted from the TRB Transportation Research E-Newsletter - December 12, 2002

Air-fed deer whistles, those small plastic devices attached to car bumpers to scare deer from roadways, are “acoustically ineffective”. That is the finding of a scientific study conducted by Peter Scheifele, an animal bioacoustics and audiology expert at the University of Connecticut.

On highways and byways across North America, nearly 750,000 collisions occur each year between deer and vehicles. Manufacturers promote deer whistles as “acoustic attention-getters”, alleging deer will react to the whistle by remaining still.

“There has been a lot of conjecture about whether the whistles work or don’t work, and we are one of the first independent groups to scientifically test them,” says Scheifele, Director of Bioacoustic Research at the National Undersea Research Center at the University of Connecticut’s Avery Point campus and researcher in the Department of Animal Science.

He and his team tested six air-fed whistles in the laboratory and in the field. The study’s goal was to determine the actual frequencies generated by the whistles and the intensity at which they are produced; compare that data to the hearing abilities of deer; and then take the animal’s acoustic behavior into consideration.

Following the directions on each package, the team mounted the

devices onto a car’s front bumper. Using a road closed to the public, they drove the car at speeds ranging from 30 to 45 miles per hour while recording sound and data.

“We tested them strictly from an acoustical point of view,” explains Scheifele. He found that the whistles typically produce a signal either at a frequency of 3 kilohertz (kHz) or 12 kHz. Both, as it turns out, are problematic.

The hearing range of white-tailed deer, the most common species in the U.S., is between 2 and 6 kHz, so the animal is not capable of hearing the 12 kHz signal. Although deer may be capable of hearing the 3 kHz signal, it is only 3 decibels louder than the road noise created by the car, so the signal is buried. Scheifele points out that the condition would worsen with additional traffic in the area or if the wind was blowing.

Since completing the study, a new electronic whistle has been put on the market. Although Scheifele has not had an opportunity to test it, he has examined its advertising claims. He says the specs for the electronic whistle are considerably different from those of the air-fed devices, so “there is a possibility that the electronic whistle is more effective than the air-fed devices.”

But even if deer can hear the electronic signal, the University of Connecticut scientist questions how one alerts rather than startles the animal. This is where animal behavior comes into play.

“Think about the metaphor ‘deer in the headlights’,” says Scheifele. “It is used to conjure up an image

of someone who is confused or frightened. When deer sense something unusual, we do not know for sure how they are going to react.”

Will they freeze in their tracks, run off, or charge towards the sound? Their behavior is related to the “fight-or-flight response”. According to scientific literature on the subject, there is an amount of space in which an animal feels safe; but once that boundary is violated, the animal’s reaction is unpredictable. Its response will depend on a number of factors, including age, sex, type of enemy, and surroundings.

“All in all, the air-fed whistles do not make sense to me acoustically,” states Scheifele. ▲



What's New with Context Sensitive Design

Changing the Way We Do Business

By Brian Hasselbach, WSDOT
Design Office

Washington State's population is growing at a rate that is placing ever-increasing demands upon our transportation system. Urban roadways, in particular, are suffering from significant additional burdens. Engineers and planners from state and local agencies are challenged by the need to reconcile multiple, sometimes conflicting, expectations for urban roadways.



Lakeway Drive in Bellingham, WA illustrates the balance between the safety requirements of a roadway and the aesthetic desires of a city.

Much of the apparent conflict involves balancing safety needs, which the Washington State Department of Transportation (WSDOT) has an obligation to ensure and is subsequently held accountable for, with the desire for aesthetic design features.

Much of the apparent conflict involves balancing safety needs, which the Washington State Department of Transportation (WSDOT) is obligated to ensure and is subsequently held accountable, with the desire for aesthetic design features. Many of these features, however, are considered fixed objects, as defined by the AASHTO Roadside Design Guide, and are often located within the design clear zone. Decisions are further complicated by a variety of related issues including access management, urban median design, utility pole location, bike and pedestrian access and safety, transit service, trees, landscaping

and other aesthetic improvements, capacity demand, traffic calming, and process issues, including the route development plan approval process and project development schedules.

On a national level, the Federal Highway Administration (FHWA) has been promoting the use of Context-Sensitive Design (CSD) to address these issues. Essentially, CSD is the practice of using a collaborative, interdisciplinary approach that relies on the involvement of key stakeholders to balance the safety and efficiency needs of a project, with the integration of the project into the

existing natural, social, economic and cultural environments. CSD prompts transportation agencies to interact with key stakeholders to develop a project purpose and need that satisfies a full range of users. This generally results in early community buy-off on a project. Projects are generally developed in harmony with the community and preserve the environmental, scenic, aesthetic, historic and natural resource values of the area; projects are generally built with minimal disruption to the community; and they generally involve the efficient and effective use of resources (time and budget) of all involved parties.

So, what is Washington State doing on a local level? The challenge of balancing safety and aesthetics in roadway designs is not a new issue for WSDOT, and in the past couple of years WSDOT has initiated two major endeavors that refine its current efforts and provide a more holistic approach to addressing these issues. The first endeavor is WSDOT's Design Office Safety, Aesthetics and Context-Sensitive Design effort and the second is WSDOT's Highways & Local Programs Community Partnerships Forum. Both of these endeavors derive from a Washington Transportation Commission policy directing WSDOT to "provide and promote civic engagement and a sense of place through safe, sustainable choices for a variety of elements including housing, transportation, education, cultural diversity, enrichment and recreation."

First, a little over a year and a half ago WSDOT's Design Office initiated the Safety, Aesthetics and Context-Sensitive Design effort - a multi-faceted undertaking that builds on the Department's existing efforts to balance its obligation to provide safe transportation systems with the desire for aesthetic roadway designs. This will help promote the use of the

The challenge of balancing safety and aesthetics in roadway designs is not a new issue for WSDOT, and in the past couple of years WSDOT has initiated two major endeavors that refine its current efforts and provide a more holistic approach to addressing these issues.



fundamental principles of CSD into the project development process.

In the true spirit of CSD, WSDOT kicked off the Safety, Aesthetics and Context-Sensitive Design effort by establishing an interdisciplinary group to guide the development of work-plans and desired products. The group includes representatives from cities, counties, FHWA, regional planning councils, the Association of Washington Cities, the County Road Administration Board, the Department of Community, Trade, and Economic Development, and various disciplines and offices within WSDOT including, Design, Planning, Traffic, Project Development, Environmental Affairs, Highways & Local Programs, Tribal Liaison, and Landscape Design. This coordinated effort is an obvious benefit in furthering strong communication efforts and working relationships between local agencies and WSDOT.

The group has made significant progress in a little over a year's time. Task groups have devised solutions for the most urgent issues, such as urban clear zone requirements on state highways, creating an urban design alternative treatments brochure, and clarifying jurisdictional responsibilities for design elements on state highways within incorporated limits of cities and towns.

The next major endeavor of the group is the development of a companion document to WSDOT's Design Manual. The companion document will provide conceptual guidance for the application of context-sensitive design to the project development process and will complement the Community Partnerships Forum's "Building Projects that Build Communities."

The intent of the companion document is to provide a compilation of the issues that are

involved with highway design. The document will provide background information on why a particular issue is of concern, discussions on balancing considerations, and will prompt the user to think about how a particular issue influences or is influenced by other considerations. The document is not intended to provide design guidance; rather, it will be a tool to assist in developing context-sensitive projects. It is the intent of the companion document to inspire excellence in design and prompt users to coordinate with stakeholders to best optimize the existing, surrounding conditions to the greatest extent possible.

Development of the companion document is underway - utilizing the talents of experts both internal and external to WSDOT. Completion of the document is expected by June 2003. A copy of the outline for the document, as well as the draft introduction to the document, can be found at: <http://www.wsdot.wa.gov/eesc/design/Urban/ArterialDesignGuidanceDevelopmentAdvisoryGroup.htm>.

The interdisciplinary group has also identified the need to develop or offer existing training on CSD. This was recognized in the Community Partnership Forum, and so, Highways & Local Programs and the Design Office are working on developing a training program that will be available to both WSDOT and local agencies. Check WSDOT's Context Sensitive Solutions web site at <http://www.wsdot.wa.gov/biz/csd/> for all of the Department's updates on upcoming training opportunities and products.

For the second endeavor to balance safety and aesthetics in roadway design, WSDOT's Highways and Local Programs convened a forum tasked with improving WSDOT's interactions with local jurisdictions; particularly on projects planned, scoped, and built within urban areas. The Community Partnerships

*It is the intent of
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document to inspire
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and prompt users
to coordinate
with stakeholders
to best optimize
the existing,
surrounding
conditions to the
greatest extent
possible.*

Forum includes representatives from FHWA, Association of Washington Cities, Sound Transit, cities, counties, consulting firms, and various disciplines within WSDOT, including Highways & Local Programs, Planning, Traffic, Design, and Construction.

The Forum spurred a new plan of action for the Department regarding our approach to joint projects. The Forum committed to improving the processes in which transportation partners interact with one another. To accomplish this goal, the Forum evaluated the best and most expeditious ways to deliver successful projects—from the earliest inception of the project to the completed construction to quality of documentation—in order to meet local, regional, and state transportation goals. The Forum quickly recognized that a key element in accomplishing these goals is in the broad dissemination of information on how projects can best be planned, designed, and constructed.

As a result, the Forum has developed a best practices

guidebook, "Building Projects that Build Communities," as a resource for both local agencies and WSDOT staff to:

- Help local agencies understand the process for developing a project from beginning to end.
- Describe helpful tools all transportation agencies can employ to ensure successful partnering projects.

The final version of the guidebook is currently being published for hard copy distribution and will also be available on-line on the WSDOT Context Sensitive Solution web site at <http://www.wsdot.wa.gov/biz/csd/>.

Additionally, the Forum developed a full set of recommendations that were presented to the WSDOT Executive Team. The Forum also recommended the creation of a Resource Center. The Resource Center will be primarily a "virtual" web-based resource, but will also offer community visioning assistance, publication, and other assistance as needed and available. Anticipated completion time for the website is February 2003.

For more information on WSDOT Highways and Local Programs' Community Partnerships Forum, contact Julie Matlick, WSDOT H&LP, at (360) 705-7505 or matlicj@wsdot.wa.gov. For more information on WSDOT's Safety, Aesthetics and Context Sensitive Design effort, contact Brian Hasselbach, WSDOT Design Office, at (360) 705-7255 or hasselb@wsdot.wa.gov. ▲

Pavement Management Systems

A Powerful Tool for Performance Monitoring

Reprinted from Focus, November 2002

How are Superpave pavements performing in your State? Your pavement management system (PMS) can help you find out. A recent Federal Highway Administration (FHWA) study examined how existing pavement management data, combined with materials and construction-related data, could be used to evaluate new design or materials concepts such as Superpave in Arizona, Florida, Indiana, Maryland, and Washington State. "With data from a PMS, along with data from other systems such as materials and construction, you should be able to paint a pretty good picture of how a pavement is performing," says Project Coordinator Pim Visser of TRDI, Inc. The study's other primary objectives were to determine what data States collect in common, what data could be combined and used for a multi-State data analysis, and what can be done to make data from different States more compatible.

Most highway agencies primarily use their PMS data at the network level for programming, planning, and budgeting. PMS databases generally contain at least the following information:

- Location of the pavement section
- Type of pavement
- Age
- Traffic information
- Performance indicators for ride, cracking, rutting, and friction
- Year of testing.

The PMS's in the five States visited

One highway agency that has made a major effort to put many of its essential data on pavement materials and construction in electronic format is the Washington State Department of Transportation (WSDOT).



contained performance data on such criteria as rutting and cracking for 1 to 4 years for Superpave pavements. However, they often had no link between the performance data and details on materials characteristics, as-constructed thickness, construction data, or quality control (QC)/quality assurance (QA) data, which are usually not readily available in electronic format. To assess the performance characteristics of pave-

ments, a combination of data, including material properties, traffic, and weather, is needed. Most States have this data but are not currently combining it for analysis.

One highway agency that has made a major effort to put many of its essential data on pavement materials and construction in electronic format is the Washington State Department of Transportation (WSDOT). This has been integrated and linked with performance data for Superpave and SMA pavements on a Web-based database known as HMA View developed by the University of Washington. Started in early 2001, the Web site allows WSDOT to track the performance of pavements by looking at such characteristics as whether they are rutting or cracking. "It's a wonderful tool that allows you to look at the field data during production via automated control charts, which are all on one page for easy viewing and analysis," says Kim Willoughby of WSDOT. "Also, the pavements' performance over time can be monitored and linked to actual field test results."

The FHWA study used HMA View for the second part of its research. Known as the Pathfinder Study, this initiative was designed to serve as an example of how a highway agency can identify and collect the data needed to assess the performance of Superpave pavements or other new design or materials concepts, as well as to determine how much effort is required to enter the data into one or more electronic databases. Data fields from the Maryland State Highway Administration's (SHA) QC/QA, pavement design, mix



Pavement management system data can be a valuable tool in analyzing the performance of pavements.

design, and PMS files were selected and data was collected from seven Superpave projects constructed since 1999. Data collection took 2 months of effort as not all of the data was in electronic format. The data was then loaded into HMA View, resulting in a substantial database. Some gaps, however, still remained. This meant that no analysis could be done for such indicators as cracking, the effects of mix temperature, the influence of day or night paving, or the effects of actual versus designed layer thickness. Another limitation was that there was only 1 or 2 years of performance data, so it was difficult to create meaningful plots of performance over time.

Despite the limitations encountered, the project successfully demonstrated how a State highway agency could assemble a detailed database that could be used to evaluate the performance of Superpave and other design and new material concepts. "It has become clear that there is much more data present in PMS, pavement design, materials, and construction files than is currently used or accessible for performance monitoring and that some of the missing data could easily be collated in the future," noted the report produced by the project team.

The project also demonstrated the advantages in collecting data in electronic format, making it easily accessible for other applications. "Putting things in electronic format requires a change in attitude and the realization that this data can be useful in many applications and for many departments," says Visser of TRDI, Inc.

Since the Pathfinder study, Maryland SHA has continued working with the University of Washington on a pilot performance monitoring project. "Using HMA View, we have merged seven databases that monitor materials, construction, and performance into one program," says Gloria Burke of Maryland SHA. This pilot project is for an 8-km (5-mi) section of roadway resurfacing located on I-68 in western Maryland. The seven databases track pavement design, project performance, ride quality, binders, construction details, mix design, and QC/QA. The combined data is being uploaded into a version of HMA View customized for Maryland, which includes maps, control charts, and thermal and digital images. "The project is working very well," says Burke. "We are planning to use HMA View even more in the future."

Recommendations made by the FHWA study included undertaking a more detailed multi-State study in the future to analyze the performance of the Superpave system. This would allow States to combine their efforts and could produce a large analysis database of lasting value. The study also noted that "it is important that data used for performance evaluation be accurately and uniformly collected." Data collection protocols currently being reviewed by the American Association of State Highway and Transportation Officials will help in setting a common data collection standard once they are finalized. While the study demonstrated the value of PMS databases in analyzing the performance of Superpave pavements, PMS data can be used in many other applications, such as analyzing the performance of recycled materials, high-performance materials, and pavements constructed using performance-related specifications. And with the forthcoming release of the 2002 AASHTO Design Guide, PMS data can also be employed in analyzing the performance of pavements constructed using mechanistic design principles.

For more information on the PMS Performance Monitoring study, contact Sonya Hill at FHWA, 202-366-1337 (fax: 202-366-9981; email: sonya.hill@fhwa.dot.gov). The study report can be found on the Web at www.fhwa.dot.gov/infrastructure/asstmgmt/pms.htm. For more information on HMA View, contact George White at the University of Washington, 206-685-7198 (email: gcw@u.washington.edu) or Kim Willoughby at WSDOT, 360-709-5474 (email: willouk@wsdot.wa.gov). You can also visit the HMA View Web site at hotmix.ce.washington.edu/hma. For more information on Maryland's use of HMA View, contact Gloria Burke at 800-477-7435 (email: gburke@sha.state.md.us). ▲

The ADA and Transportation:

Improving Safety and Access on Public Rights-of-Way

Reprinted from Focus, November 2002

For the more than 54 million Americans with disabilities, transportation is a vital link to participating in all aspects of society, including work, commerce, and leisure activities. The U.S. Department of Transportation is committed to carrying out the 1990 Americans with Disabilities Act (ADA) and building a transportation system that provides equal access for all persons. As part of this effort, the Federal Highway Administration (FHWA) is working with the Access Board, a Federal agency that focuses on accessible design, to produce guidelines that cover access to sidewalks and streets, including crosswalks, curb ramps, street furnishings, parking, and other components of public rights-of-way.

FHWA is the lead agency in ensuring that access for persons with disabilities is provided wherever a pedestrian way is newly built or altered, and that the same degree of convenience, accessibility, and safety available to the general public is provided to persons with disabilities. The Access Board and FHWA are active partners in fulfilling this mission.

In 1992 and 1994, the Board proposed guidelines for public rights-of-way. Due to comments it received, the Board decided to coordinate with the transportation industry and State and local governments on the rulemaking process. This effort led to the development of an outreach and training program on accessible public rights-of-way, and in 1999, the Board chartered an advisory committee to develop recommendations on access guidelines. The committee's recommendations are contained in a report, *Building a True Community*, which was re-

FHWA is the lead agency in ensuring that access for persons with disabilities is provided wherever a pedestrian way is newly built or altered, and that the same degree of convenience, accessibility, and safety available to the general public is provided to persons with disabilities.

leased in January 2001. The report provides criteria for sidewalks, street fixtures and furnishings, street crossings, vehicular ways, parking, and other components of public rights-of-way.

In June 2002, the Board released draft guidelines based on the committee's recommendations. The draft guidelines focus on answering questions pertaining to conditions unique to public rights-of-way, including various constraints posed by space limitations at sidewalks, roadway design practices, and terrain. Issues that often require additional guidance, such as access for blind pedestrians at road crossings, wheelchair access to on-street parking, and the construction of work zones that are detectable to a blind pedestrian, are also covered.

The Board is now preparing a proposed rule based on a review of the public comments received. The proposed rule is expected to be available for public comment in the spring of 2003.

"There is a lot to still be learned about the ADA and how it applies to public rights-of-way, but it's clear that the ADA is a tool that, through proper application, will help provide an equitable and safer lifestyle for all Americans," says Barbara McMillen of FHWA's Office of Civil Rights.

The draft guidelines and supplementary information can be found on the Web at www.access-board.gov/rowdraft.htm. Building a True Community is available at www.access-board.gov/provac/commrept/index.htm. Copies of the documents can also be obtained by contacting the Access Board at 202-272-0080 (TTY: 202-272-0082). Alternative formats are available upon request.

Additional guidance can be found in two FHWA publications: *Designing Sidewalks and Trails for Access, Part I* (Publication No. FHWA-HEP-99-006) is available online at www.fhwa.dot.gov/environment/bikeped/access-1.htm, while *Part II* (Publication No. FHWA-EP-01-027) of the document can be obtained from the FHWA Research and Technology Report Center, 301-577-0818 (fax: 301-577-1421).

For more information on the ADA and the proposed design guidelines, visit the Access Board's Web site at www.access-board.gov. For more information on FHWA's work to implement the ADA, contact Barbara McMillen at FHWA, 202-366-4634 (email: barbara.mcmillen@fhwa.dot.gov).



Next Step in Differential GPS Evolution:

10 Centimeter Accuracy

Reprint from Research & Technology Transporter, June/July 2002

Heavy rains and snowstorms reduce visibility, making it difficult for drivers to keep their eyes and wheels on the road. Continuing advancements in global positioning systems (GPS) might one day enable drivers and snowplow operators to stay within their lanes or make it easier for surveyors to measure the height, positioning, and coordinates of a specific area.

At one research site in Hagerstown, Maryland, Federal Highway Administration (FHWA) researchers from the Turner-Fairbank Highway Research Center (TFHRC) improved the precision of the Nationwide Differential Global Positioning System (NDGPS), calling the new technology High Accuracy-Nationwide Differential Global Positioning System (HA-NDGPS).

Like a standard GPS unit, HA-NDGPS uses satellite transmissions to provide information about the

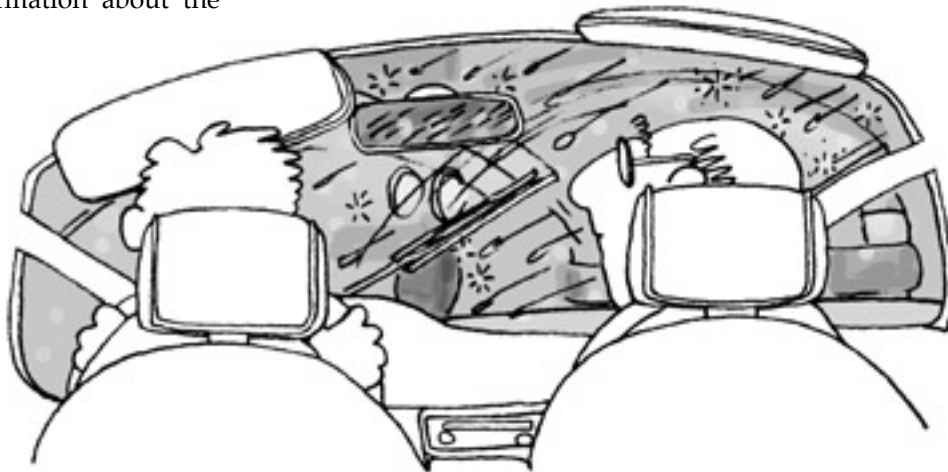
specific location of an object in the United States. HA-NDGPS, however, calculates the error in the GPS navigation solution (coordinates) and broadcasts a correction to receivers located within range of the transmitter, allowing even greater accuracy. In fact, researchers estimate the accuracy to be within 10 centimeters (or 4 inches). That's about the width of a roadway lane marking!

Engineers estimate the accuracy of the new HA-NDGPS will hold true to within 320 kilometers (or 200 miles) of a transmitter. This opens the door for the transportation industry to use the system to survey land more accurately; track and ensure that snowplows stay on the road; provide drivers with real-time mapping and positioning of their commercial and private vehicles; move freight around a port; and keep passenger vehicles safely within a lane and on the road.

With HA-NDGPS, engineers can improve the accuracy of radionavigation by correcting delays caused by atmospheric interference, clock-time errors, satellite positioning, solar wind, gravitational forces, etc. Ultimately, HA-NDGPS could help provide radionavigation service that enhances safety by facilitating a host of transportation safety applications, including lane-departure warnings.

Today, individuals and organizations from both the public and private sectors are using the existing NDGPS technologies with 1- to 3-meter (3- to 10-foot) accuracy for everything from positioning Coast Guard navigation buoys to highway road surveying and enhanced 9-1-1 mapping.

For more information, contact Rudy Persaud at 202-493-3391 or rudy.persaud@fhwa.dot.gov, or James A. Arnold at 202-493-3265 or james.a.arnold@fhwa.dot.gov



Portable Asphalt Recycler



*By Bob Brooks, WST2 Pavement
Technology Engineer*

On October 14, 2002, Bill McEntire and the Clark County Operations Center in Vancouver, WA graciously hosted a demonstration of the Bagela 7000 Asphalt Recycler, which is sold by Hot Asphalt Recycling, Inc. of Vista, California. There are two different sized recyclers that are sold: the one demonstrated in Vancouver, the Bagela 7000, is a 7-ton per hour machine and the Bagela 10000 is a 10-ton per hour machine. Both machines are trailerable and utilize either asphalt spoils or grindings.

Both machines are mounted on their own trailers and are easily towable to a work site. Asphalt spoils or grindings are loaded into a hopper on top of the machine, which in turn is dumped into the heating drum as needed. During the demonstration, pavement spoils as large as 1 to 1 1/2 feet wide were fed into the hopper. A special additive is added to the hopper to rejuvenate the asphalt and the mixture is heated. In approximately 15 - 20 minutes hot mix asphalt is ready to be dumped, spread, and rolled. The rejuvenator comes in blocks and consists of asphalt oils,



Pavement spoils.

copolymers, and crumb rubber. One or two blocks are used per ton of asphalt depending upon the age and brittleness of the old pavement being recycled.

The demonstration of the Bagela 7000 was not without problems. These machines are made in Germany, and as such, they conform to European (metric) standards. The Bagela 7000 developed a fuel leak the night before the demonstration, and a fuel line fitting needed to be removed and repaired before the demonstration could proceed. This proved a difficult task since no suitable fittings were available locally and the part had to be re-welded with only partial success. A repair kit comes with the machine and contains some of the more commonly needed parts, but not the fuel line fittings. In addition, the discharge gate on the heating drum was stuck closed and the operator spent an additional 30 minutes or so freeing the gate before the demonstration could proceed.

To get the stated production from these machines requires regular feeding of the hopper with a bucket loader. This means that in addition to the recycler and its operator, a bucket loader and operator must accompany the machine into the field. If timed properly, the same bucket loader can be used to collect and distribute the heated asphalt as well. The recycler operator, in addition to watching the temperature and other controls, must estimate the tons of asphalt being run through the machine so that the proper amount of rejuvenator blocks can be added to the mix. The resulting mix is suitable for patches, trenches, and base-course material. An optional self-drive mechanism is available for these recyclers that will allow the machine to be positioned over a trench and then be driven along discharging mix without the need of the tow vehicle. Another, perhaps better, option is to set the recycler up in a permanent location



in the maintenance yard and make the mix there and then transport it to the job site in a hotbox.

So, how did it perform? Once the recycler was operational, it produced a decent looking mix suitable for the aforementioned uses. However, the machine also produced a fair amount of smoke and fumes in the process. This could be a potential problem in the field requiring the use of an optional air cleaner attachment (not demonstrated) to cut down the exposure to the crew, the public, and the environment in general.

The cost of purchasing one of these recyclers depends on the configuration of the machine. The base cost of the Bagela 7000 is approximately \$70,000 and the Bagela 10000 is approximately \$104,000, both include the trailer. The optional self-drive mechanism runs an additional \$6,600 and the air filter an additional \$15,000. The heating drum has a life rating of 5,000 hours and new drums can be purchased. To produce a ton of hot mix requires between one and two gallons of diesel fuel and the addition of one or two rejuvenator blocks at approximately \$10.00 per block. Rejuvenator blocks must be ordered in pallet sized loads (144 blocks). A ton of mix costs between \$11.50 and \$23.00 to produce depending on the amount of fuel and additives used, not counting equipment or operator costs. ▲



Top Photo: Pavement spoils are dumped into hopper.

Middle Photo: Special additive added to the hopper and the mixture is heated.

Bottom Photo: Hot mix asphalt ready to be dumped.

New Tool Reshapes Crushed Culvert Ends

Reprinted from the "Illinois Interchange," Summer 2002

A common problem that restricts drainage in rural areas is the crushed ends of metal culvert pipes. Replacing the whole pipe just to eliminate the crushed end is expensive and a waste of taxpayers' money. Yet, anyone who has tried to fix them using a standard jack knows how ineffective that method is.

Douglas Wright, at The Center for Local Government Technology in Oklahoma, has built a hydraulic reshaper as a solution. The reshaper was designed to be built from common off-the-shelf components with a minimum amount of machining and welding involved. People working in maintenance shops have built several for around \$270 each.

The collapsed jack is placed in the end of the crushed pipe. As the cylinder is retracted, the jack

expands and the pipe is reshaped. According to Wright, the process takes about as long as it takes to read this article.

Mr. Wright notes that an effort has been made to make this device as safe as possible for the operator. The "safety" switch ensures both hands will be on the device while it is operated and the relatively low pump delivery will make the expansion rate slow under load. Extreme caution should still be used! As with any hand-held, power tool, it is potentially dangerous.

The T2 office has a materials list and complete set of plans, if you are interested. Contact Bob Brooks at 360-705-7352 to order a set.



THE MANUAL ON UNIFORM Pavement Marking Information



For roadway pavement marking engineers and managers, the following website contains information on pavement marking materials used in some states and Federal Lands. <http://www.washtox.org/synopsis/8-13-2002.pdf>

Safety Effectiveness of Intersection Left- and Right-Turn Lanes

Reprinted from Tech Brief Report No. FHWA-RD-02-031

A new report called Safety Effectiveness of Intersection Left- and Right-Turn Lanes (RD-02-089) from the Federal Highway Administration (FHWA) presents the results of research on the safety effectiveness of providing left- and right-turn lanes for at-grade intersections.¹ The research was performed as part of a pooled-fund study; highway agencies in the District of Columbia and the States of Iowa, Illinois, Louisiana, Minnesota, Montana, Nebraska, New Jersey, North Carolina, Oregon, and Virginia all contributed a portion of the funding for the research.

Literature Review and Project Priorities

The research began with a review of published literature related to the safety effectiveness of intersection design and traffic control elements. This review summarized current knowledge on the safety effects of a broad range of intersection features. Safety effectiveness estimates exist for many features. In many cases, however, the validity of those estimates is in question, because the estimates were based on studies that were poorly designed and executed. Based on the literature review, representatives of the participating States decided that the research should focus on quantifying the safety effectiveness of left- and right-turn lanes through a well-designed before-after evaluation.



Right-turn lane was installed at this signalized intersection located at SR 159 and Center Grove Rd/Goshen Rd in Edwardsville, Illinois

Selection of Evaluation Sites

Researchers identified and selected three types of sites for the study: improved or treatment sites, comparison sites, and reference sites. The database assembled for the study included 580 intersections of these three types, as explained below.

The improved or treatment sites are intersections at which a left- or right-turn lane was added and for which data on intersection geometrics, traffic volumes, and traffic accidents were available for time periods before and after the improvement. These improvements were made at existing unsignalized intersections, existing signalized intersections, and newly signalized intersections where both a turn

lane and a signal were installed at the same time at a previously unsignalized intersection. The study evaluated a total of 280 intersection improvement projects of the following types:

- Added left-turn lanes.
- Added right-turn lanes.
- Added left- and right-turn lanes at the same intersection.
- Extension of the length of an existing left- or right-turn lane.

The study was limited to projects at three- and four-leg intersections. All of the evaluation sites had either two-way STOP control or traffic signal control. All of the im-



Left-turn lane was installed at this signalized intersection located at US 18 and Pierce Avenue in Mason City, Iowa



Right-turn lane was installed at this unsignalized intersection located at US 97 and Moore Lane in Sherman County, Oregon

provement projects evaluated were constructed during the years 1989 through 1998; the vast majority of the sites were improved during the period from 1994 through 1997.

The intersections were located in eight of the States that participated in the study: Illinois, Iowa, Louisiana, Minnesota, Nebraska, North Carolina, Oregon, and Virginia. The States supplied traffic volume and accident data for the

study and permitted the research team to visit the sites and document intersection features.

For 260 of the 280 improved intersections (93 percent), researchers selected a matching comparison site that was not improved during the study period. The matching improved and comparison sites were always in the same State and were located geographically close to each other whenever practi-

cal. The matching sites were as similar to each other as possible in intersection configuration, traffic control, geometric design, and traffic volume. The other 20 improved sites were sufficiently unique that researchers could not find matching comparison sites.

In addition, researchers selected 40 reference sites. Reference sites were unimproved intersections that were not matched to any particular improved site.

Data Collection

Researchers collected extensive data for the improved, comparison, and reference sites. Field visits to nearly every study intersection provided geometric design and traffic control data.

Traffic volume data for both the major- and minor-road legs were obtained from counts or estimates for as many years as possible for each intersection from highway agency records. Intersections were only included in the study if average daily traffic volumes for the major and minor roads were available for at least one year during the study period. Traffic volume estimates for each individual year of the study period were obtained through a careful process of interpolation and extrapolation.

Researchers evaluated traffic accident records for each participating highway agency for periods before and after each of the improvement projects. The evaluation generally included all accidents within 75 m (250 ft) of each intersection that were related to the presence of the intersection, as designated by the investigating officer or accident coder. The database assembled for the 580 study intersections included a total of 26,056 intersection-related accidents (123 fatal accidents, 10,203 nonfatal injury accidents, and 15,730 property-damage-only accidents).

Study Period

The accident database used in the study included 9 to 13 years of data for each intersection. Study periods before and after each improvement project were defined with durations as long as possible, consistent with the availability of data. The data for the year in which the project was constructed were not included in either the before or after study period. The before study periods for the treatment sites ranged from 1 to 10 years, with a mean duration of 6.7 years. The after study periods also ranged from 1 to 10 years, with a mean duration of 3.9 year.

Evaluation Approaches

Researchers used three alternative statistical approaches to evaluate the effectiveness of the intersection improvement projects. These alternative approaches were:

- Before-after evaluation with yoked comparisons.
- Before-after evaluation with a comparison group.
- Before-after evaluation with the Empirical Bayes approach.

These approaches were developed from those recommended by Griffin and Flowers² and by Hauer.³ The yoked-comparison (YC) approach is a traditional approach to the evaluation of traffic accident countermeasures and involve one-to-one matching between improved and comparison sites. The safety performance of the matched comparison site is used to estimate what change in safety would have occurred at the improved site had the improvement not been made. The comparison-group (CG) approach is similar to the YC approach but replaces the single comparison site matched to each improved site with a group of similar sites whose collective safety performance serves the same purpose. The Empirical Bayes (EB)

approach replaces the comparison group with a negative binomial regression model used to predict the change in safety performance of the improved site that would have been expected had the improvement not been made.

When an intersection has relatively high accident experience during a particular time period, its annual accident frequency is likely to decrease even if it is not improved; this phenomenon is known as regression to the mean. Thus, when an improvement project is constructed at an intersection with relatively high accident experience, the natural decrease in accident frequency due to regression to the mean may be mistaken for an effect of the project. Thus, regression to the mean is a major threat to the validity of before-after evaluations.

The EB approach is the only known technique to account for the effect of regression to the mean on evaluation results. The YC and CG approach can account for the effects of changes in traffic volume levels and for general time trends in accident frequency, but not for regression to the mean. The CG approach is generally preferable to the YC approach, because the CG approach uses multiple comparison sites for each improved site and because, as implemented in this evaluation, it has a more sophisticated method to account for traffic volume changes than the YC approach. Thus, the ranking of the three evaluation approaches, in descending order of their theoretical accuracy, is EB, CG, and YC. The evaluation results confirmed this expected relative accuracy of the three methods.

Evaluation Results

Tables 1 and 2 summarize the safety effectiveness of installing left-turn lanes on the major-road approaches to rural and urban intersections, respectively. Table 3 presents comparable effectiveness

estimates for right-turn lanes that are applicable to both rural and urban intersections. The safety effectiveness of adding turn lanes is presented in the tables as the expected percentage reduction in total intersection accidents. All of the results in table 1 through 3 were derived in the current study except where noted; the full research report includes estimates of the precision of each of these results.¹ Effectiveness measures for situations not addressed in the current study were based on the findings of an expert panel convened to assess published literature in another recent FHWA study.⁴ Furthermore, all of the results from the current study shown in tables 1 through 3 are based on the EB approach, with one exception noted in table 2.

The effectiveness of projects involving the addition of both left- and right-turn lanes on the major road at the same intersection can be determined by combining the relevant effectiveness measures from tables 1 through 3. For example, at an urban four-leg signalized intersection, the addition of two major-road left-turn lanes would be expected to reduce total intersection accidents by 19 percent, and the addition of two major-road right-turn lanes would be expected to reduce accidents by 8 percent. The combined effectiveness would be computed as $1 - (1 - 0.19)(1 - 0.08) = 0.25$, or a 25-percent reduction in total intersection accidents.

No reliable effectiveness measures were found for extending the length of an existing left- or right-turn lane.

Economic evaluations of the installation of left-turn lanes at intersections of various types were conducted. The primary measure of the cost effectiveness of improvement projects is the benefit-cost ratio, which is determined as the present value of future accident costs reduced,

divided by the estimated cost of constructing the left-turn lanes. Conservative estimates of accident costs were used:

- Fatal and injury accidents - \$103,000.
- Property-damage only accidents - \$2,300.

The average cost of installing a single left-turn lane is \$85,000 based on estimates from four of the States that participated in the study.

For rural-three-leg unsignalized intersections, the results indicate that left-turn installation would become cost-effective for a major-road ADT of 4,000 vehicles/day with 10 percent of the major-road volume on the minor road and at 2,000 vehicles/day with 50 percent of the major-road volume on the minor road. For rural four-leg unsignalized intersections, left-turn lane installation would become cost-effective for a major-road ADT of 3,000 vehicles/day with 10 percent of the major-road volume on the minor road. With a minor-road volume equal to 50 percent of the major-road volume, left-turn installation would be cost effective at all of the major-road volume levels down to the lowest level considered of 1,000 vehicles/day. For urban four-leg unsignalized intersections, left-turn installation would become cost-effective for a major-road ADT of 2,000 vehicles/day with both 10 and 50 percent of the major-road volume on the minor road. For urban four-leg signalized intersections, left-turn installation was found to be cost-effective for all combinations of major- and minor-road ADTs considered. The lowest combination of major-road ADT of 10,000 vehicles/day and minor-road ADT of 2,500 vehicles/day are a benefit-cost ratio of 15.

For more information, contact Michael S. Griffith at (202) 493-3316 or mike.griffith@fhwa.dot.gov ▲

Table 1. Expected Percentage Reduction in Total Accidents From Installation of Left-Turn Lanes on the Major-Road Approaches to Rural Intersections

Intersection type	Intersection traffic control	Number of major-road approaches on which left-turn lanes are installed	
		One approach	Both approaches
Three-leg intersection	STOP sign ^a	44 ^a	
	Traffic signal	15 ^a	
Four-leg intersection	STOP sign ^a	28 ^a	48 ^a
	Traffic signal	18 ^a	33 ^a

^a STOP signs on minor-road approach(es)
^a based on EB evaluation in Reference 1
^a based on Reference 4

Table 2. Expected Percentage Reduction in Total Accidents for Installation of Left-Turn Lanes on the Major-Road Approaches to Urban Intersections

Intersection type	Intersection traffic control	Number of major-road approaches on which left-turn lanes are installed	
		One approach	Both approaches
Three-leg intersection	STOP sign ^a	33 ^a	
	Traffic signal	7 ^a	
Four-leg intersection	STOP sign ^a	27 ^a	47 ^a
	Traffic signal	10 ^a	19 ^a

^a STOP signs on minor-road approach(es)
^a based on EB evaluation in Reference 1
^a based on CG evaluation in Reference 1
^a estimated from EB results in Reference 1 and from results in Reference 4

Table 3. Expected Percentage Accident Reduction in Total Accidents from Installation of Right-Turn Lanes on the Major-Road Approaches to Rural and Urban Intersections

Intersection traffic control	Number of major-road approaches on which left-turn lanes are installed	
	One approach	Both approaches
STOP sign ^a	14 ^a	26 ^a
Traffic signal	4 ^a	8 ^a

^a STOP signs on minor-road approach(es)
^a based on EB evaluation for rural intersections in Reference 1
^a based on EB evaluation for urban intersections in Reference 1

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WSDOT and Local Agencies Share Cost Saving Ideas 2002

Pacific Northwest Transportation Technology Expo

By Dan Sunde, Technology Transfer
Engineer, WST2 Center

Once again transportation maintenance and operations personnel from around the Pacific Northwest gathered at the Grant County Fairgrounds in Moses Lake for the 3rd Pacific Northwest Transportation Technology Expo (PNTTE). For two days they shared inventions and innovative ideas they have developed to improve safety, reduce cost, and increase efficiency.

Sponsored by the Washington State Department of Transportation's (WSDOT) Highway Maintenance Office, WST2 Center, and the Federal Highway Administration (FHWA), the Technology Expo provides federal, state, and local agency transportation personnel an opportunity to share their inventions and new ideas as well as see new information as a result of current research and new technologies provided by the private sector.

Transportation personnel often invent productive tools that prove successful for their own use. These ideas would not be available to others without a means to share and demonstrate them. The purpose of the 2002 Tech Expo was to do just that. The 2002 Expo helped promote creative thinking and spread the word about these useful ideas. Crews were able to see first-hand what other shops have developed and provided them the opportunity to talk with the inventors and try out the inventions for themselves. Many of the ideas will

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own use. These
ideas would not
be available to
others without a
means to share and
demonstrate them.*

be taken back for implementation in their own shops. During the Expo crews had the opportunity to have a hands-on look at ideas from all over Washington, Oregon, and California.

In memory of the victims of the September 11, 2001 attack, this year's Expo started with a flag ceremony. At the fairgrounds' flag pavilion, the National Work Zone Memorial Wall was displayed commemorating those who have lost their lives in work zone traffic incidents.

This year's event also provided a unique demonstration. WSDOT emergency bridge crews from across the state assembled a complete Bailey bridge on the fairgrounds. Then the WSDOT Bridge Condition Office demonstrated an Under Bridge Inspection Truck or

UBIT. Bridge crews also presented a variety of special equipment used for evaluating the condition of bridges during condition assessment.

Noteworthy this year was WSDOT North Central Region's version of the Delineator Post Punch. Taking a concept that originated in WSDOT South Central Region, the North Central Region crew added an auger attachment and modified the swing mount to include a rail that allows the entire unit to slide from one side of the truck to the other. This is a great example of the evolution of a good idea.

The Oregon Department of Transportation (ODOT) presented another idea that is catching on. ODOT demonstrated their version of WSDOT's SRview digital imaging van. ODOT joins WSDOT; Marion County, OR; and Thurston County, WA in building a digital imaging platform based on the original WSDOT van, which has an agency-built system that used off-the-shelf components.

Caltrans brought their Cone Shooter, a truck that mechanically places and picks up traffic cones. The Cone Shooter was demonstrated at the first Expo in 2000 while it was still in development at the Advance Highway Maintenance Construction Technology (AHMCT) Research Center at the University of California in Davis. It has since been accepted by Caltrans and is being "hardened" for field use.

The Debris Vacuum System is



The WSDOT Emergency Bridge Crew celebrates after completing the construction of a Bailey Bridge as part of a training exercise at the Expo.



Tools and equipment were presented from federal, state, and local agencies from three states.

another piece of equipment developed by AHMCT and demonstrated at this year's Expo. It has also found its way into production. Like a huge vacuum cleaner, the Debris Vacuum System picks up roadway trash by sucking up the roadside trash via a suction tube that is remote controlled by the driver.

Local agencies and vendors were very active at this year's Expo.

Douglas County brought two outstanding pieces of equipment they created; a truck mounted hydraulic sign post auger and a very innovative "Gravel Road Maintainer." The Gravel Road Maintainer is a mini road grader that is towed behind a pickup

Networking and sharing ideas is a key element to the success of the PNTTE.



and operated hydraulically from inside the truck. The city of Oak Harbor demonstrated a very convenient and well-organized storage unit for a jackhammer and bits. It's a real back saver! Over 50 vendors also participated this year with a wide variety of new equipment supporting traffic operations, maintenance, and construction.

Once again the Pacific Northwest Transportation Technology Expo was a great success with great ideas exchanged and new ideas generated.



Bill Evans, FHWA LTAP Manager from Washington D.C., honored the PNTTE with a visit (Bill Evans on the left and Dan Sunde, WST2 Center, on the right).



Bridge deck panel goes into place on Bailey Bridge during WSDOT training exercise.



Vendors got to show their stuff



Aaron Railey, UC Davis-AHMCT, explains the Caltrans "Cone Shooter", one of several pieces of equipment brought from out of state.



Multnomah County, Oregon brought their 4 x 4 Spreader Box, one of several Oregon Mousetraps.



Over 50 vendors demonstrated new technologies and products to improve efficiency and safety.



Crowd gathers around WSDOT demonstration of joystick control system for snowplows developed by the WSDOT North Central Region.



The city of Oak Harbor's very practical Jackhammer Storage Unit is a real back saver.



Multnomah County's Manhole Leveling System is simple but effective.



Virtually all aspects of the snowplow can be operated with a twist of the wrist using the joystick control designed by WSDOT North Central Region.



WSDOT NCR's Delineator Post Punch includes an auger.



Mousetraps ranged from hi-tech computer systems to practical low-tech solutions.



Getting the "straight skinny" from the inventor.



Douglas County also brought their truck-mounted Hydraulic Post Hole Digger.



WSDOT North Central Region demonstrates their version of the Delineator Post Punch, which is based on a previous version built by the WSDOT South Central Region.



Participants get up close to the action.

WSDOT Olympic Region's Road Warrior is packed with innovations and custom features.



Middle Left: A close-up of the WSDOT-NCR Delineator Post Punch mounting system.



Middle Right: Douglas County's Gravel Road Maintainer was a big hit.



Bottom: Over 50 vendors displayed their current technology.



Top: WSDOT Bridge Office UBIT was demonstrated on the Bailey Bridge.

Bottom Left: WSDOT's SRView van is a great example of a high-tech mousetrap.

Bottom Right: The Roadside Vacuum System represents a successful implementation of research from the Advanced Highway Maintenance & Construction Transportation Research Center, UC Davis.



Your PNTTE Event Team. Back Row Lt to Rt: Dan Sunde (Co-chair), WST2 Center; Marty Weed, WSDOT-Olympic Region; Ron Nanny, WSDOT-SW Region; Sandy Nanny, Volunteer; Kelly Newell, Washington State University-Conference & Professional Programs; Gary Haag, WSDOT-NC Region; Jenna Foster, WSU-C&PP. Front Row Lt to RT: Al Holman, Grant County Fairgrounds; Lon Ostensen, Clark County; Dennis Koering, Force America; Keith Walker, WSDOT-NC Region; Loretta Wilcox, Volunteer; Clay Wilcox (Co-chair), WSDOT-Olympic Region. Not Shown: Cathy Nicholas, FHWA; Casey McGill, WSDOT-SC Region; David Berkman, ADDCO



Top: Honoring those who have lost their lives in work zones.



Bottom: A moment of silence for those who lost their lives in the September 11, 2001 attack on the World Trade Center.

Washington State Department of Transportation's I-5 and I-90 Tunnel Fire Protection System Upgrade Project



By Jay LaVassar, WSDOT Project Engineer

The 21st century presents new challenges to transportation engineers, agencies, and contractors. Control systems have been added to highways, bridges, and tunnels to monitor traffic, inform motorists, and minimize the effects of accidents, fires, and disasters.

Inside the tunnels, these systems operate sensors, dampers, fans, signs, and a foam sprinkler system and are capable of controlling gasoline tanker fires inside the tunnel. WSDOT's three tunnel Fire Monitoring and Control (FM&C) Systems have operated reliably and there have been no fires with loss of life occurring in any of the tunnels.

A recent analysis of the existing

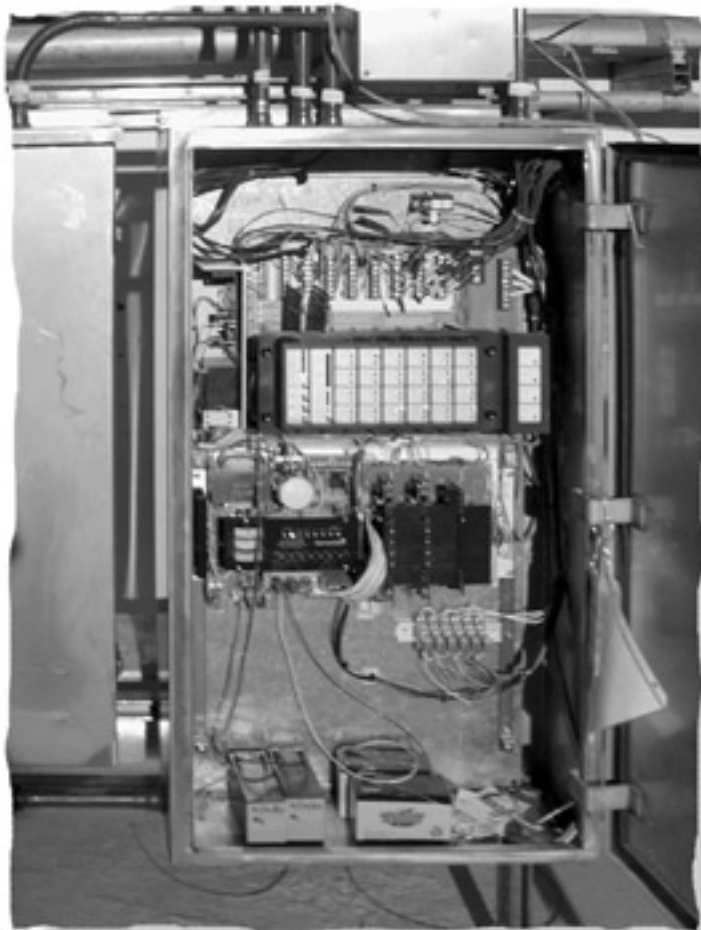
FM&C Systems showed the combination to be outmoded and requiring improvement. Some of the system components are obsolete, parts are difficult to obtain, processing speeds are slow, and graphic displays misleading. Operation of the FM&C Systems involve complex operator interfaces, difficulties in obtaining and evaluating alarm messages, and different operating information for each tunnel.

The FM&C System rehabilitation project provides a complete overhaul of the existing fire control system for both the I-90 and Convention Center tunnels. It replaces the local input/output panels (LIOPs), computers, operator stations, manual control stations, and associated wiring. At the I-90 tunnels the existing fire detectors and associated wiring to the LIOPs

would remain together with interfaces to tunnel ventilation equipment and traffic control through the VAX computer. At each tunnel the fire control system would interface with WSDOT's fiber optic transmission network, which communicates to the Traffic Systems Management Center (TSMC) located at 15700 Dayton Avenue North in Seattle. The tunnels can be controlled remotely from the TSMC.

The project construction sequencing was developed to minimize the downtime while building the fire zones by satisfactorily completing a portion of the system before work is undertaken at other locations.

Construction coordination is essential for the rehabilitation of the FM&C Systems. A key to the success of the project is selecting



contractors and suppliers with the proper qualifications to do the work. Specifically, we required the contractor to supply fire protection equipment for large projects of comparable size. A software developer with experience in VAX/variable message signs operating systems is also required.

As transportation projects move into new areas that involve information technology (IT) control, management, and safety systems, we will see more projects like this one. Many of these IT and safety systems installed in the past have already become obsolete and must now be upgraded. These upgrades present new challenges to engineers and maintenance personnel as well as contractors—namely how to maintain the safe operation of facilities while at the same time modifying them.

These goals can only be accomplished safely and successfully by carefully minimizing risk through better coordination, partnering, communication, and planning between all those involved in the operation of the facility and associated with the construction of the project.

The I-5 and I-90 Convention Center, First Hill and Mt. Baker Tunnels and Dayton TSMC System Upgrade project costs about \$3.2 million and is about two-thirds complete.

For further information about this project, please contact Jay LaVassar, Project Engineer at lavassj@wsdot.wa.gov or at (425) 793-1760. ▲

THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)



**Federal Register
published the
revision of the
MUTCD
regarding Accessible
Pedestrian Signals as
an interim rule
on July 30, 2002.
The final rule was
effective on
August 29, 2002.**



*The
"Better Mousetrap"
is awarded each quarter
for the most innovative
working ideas presented
by a public agency and
published in WST2.*

Award:

The best concepts will be published in the WST2 and posted on the WST2 Web Page.

Published mousetraps will receive a "Better Mousetrap" baseball cap and certificate.

Published mousetraps will be included in competition for the annual "Crystal Mouse" award.

Eligibility:

Washington State Public Agencies.

Mail To:

"Better Mousetrap"
WST2 Center/WSDOT
P.O. Box 47390
Olympia, WA 98504-7390

E-mail:

WST2Center@wsdot.wa.gov

For questions:

Dan Sunde,
Technology Transfer Engineer
SundeD@wsdot.wa.gov
(360) 705-7390

"Better Mousetrap" Submittal Form

Agency: _____

E-mail Address: _____

Address: _____

City: _____

State: _____

Zip+4 _____

Phone Number : () _____

Developer's Name(s): _____

Title: _____

Agency: _____

E-mail Address: _____

Address: _____

City: _____

State: _____

Zip+4 _____

Description of the "Better Mousetrap"

Why was it necessary? _____

How does it work? _____

How was it built? (Include Sketches, Photos, Drawings) _____

How does it perform? _____

Please add a sketch with dimensions and materials used!
We will draw plans from them so others can build it too!

Grant County's Enclosed Sander Heating System

By Dave Sorensen, WST2 Traffic Technology Engineer

Snow and ice control season is here once again. Keeping traffic moving safely is the primary goal of the Grant County Road District during the winter months. Snowplows are run 10 to 12 hours a day over hills and steep grades. Extreme conditions, resulting from blizzards, freezing rain and snow, and contaminated sand, develop when crews are using the sanders during low temperature operations. One of the problems encountered during these conditions is that sand in the trucks has a tendency to freeze or crust over in the sander. This can cause conveyors in the truck to plug up with frozen chunks of snow and ice.

Grant County Road District #3 employees Mike Goll and Mark Cummings, always looking for a better way to do business, came up with a solution. They invented a system using truck engine exhaust heat. This was really ingenious and simple. The exhaust is routed through the sides of the closed sander, which transfers the heat to the truck bed. Insulation was added to the sides of the truck bed and enclosed with a sheet of stainless steel. Adding the insulation keeps the heat from wicking away to the cold outside. By adding heat to the critical area around the conveyor, the amount of sand bridging is kept to a minimum.

Mike and Mark contacted the truck engine manufacturer to obtain

proper exhaust backpressure and flow specifications before building the heating system. Checking with the manufacturer is recommended prior to constructing this system. Once the specifications were obtained, a 5", inside-diameter pipe was tied into the muffler outlet pipe. Then the pipe was connected to a 90-degree elbow and run vertically behind the cab to another 90-degree elbow, changing the pipe direction to horizontal. The vertical straight pipe between those 90-degree elbows is actually two pieces held together with a pipe clamp. The pipes can be disconnected to cap off the pipe from the muffler in summertime when the system is not needed.

From the second 90-degree elbow, the pipe is then connected into a "Y" pipe. This splits the exhaust stream into two pipes that run on each side of the truck the length of the sander to the back and then capped off with 4", 90-degree elbows. The last 90-degree elbow redirected the exhaust towards the ground. In this application, the pipe size was reduced from 5" to 4" after the "Y" connector. All pipe dimensions are inside diameter.

Holes were cut through the truck wall supports to accommodate the run of pipe. After the exhaust tubing was secured with bolts, Reflex insulation, which has a 97% reflectivity, was glued to the inside of the sheet metal using a heat resistant adhesive, thereby forcing the heat from the exhaust to the inside. All metal was then primed

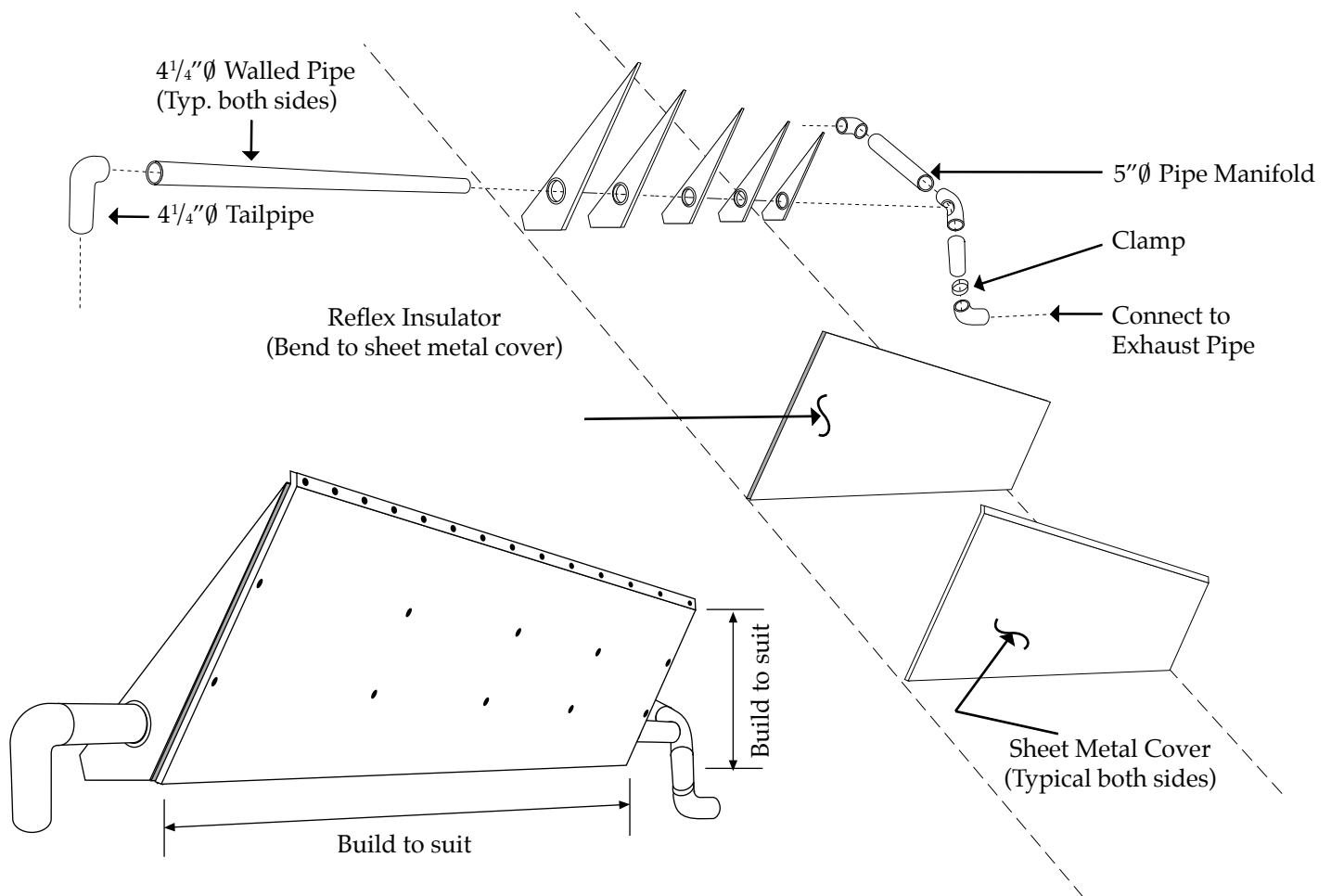
and painted to match.

The first version of this system worked well last winter; however, it did not have the insulation added. Early last spring the new and improved system, with added insulation, was completed, but it could not be tested thoroughly without cold winter conditions.

During testing last spring, the sander truck was loaded with sand to simulate actual operations. After the test was completed and all sand was emptied, the inside walls of the truck were left steaming hot. The crew is anxiously awaiting the first snowfall to test the new and improved design.

For more information, questions or comments, please contact Rusty Soelter, Grant County Road District #3 at (509) 787-2321.





Remember, share the road with snowplows.

Drive with care when snowplows are in sight. They travel slowly, usually under 40 miles per hour. Consider this before you are tempted to pass:

- Snowplow drivers need to concentrate on their task and the road conditions in front of them, so they may not spot a vehicle trying to pass.
- Some snowplows may be equipped with a "wing plow," an eight-foot extension off the right side of the truck. It allows the operator to clear snow from the driving lane and shoulder at the same time. The wing plows can be hard to see, so never pass a snowplow on the right.
- Plows also spread sand or chemicals on the road. Leave enough room to avoid having your car peppered with grit or splashed with chemicals.
- Snowplow operators check regularly for traffic behind them. If there is a traffic build-up and no passing lane, they will look for a safe location to pull over and let motorists pass. ▲

A Better Way To Clean: Portable Sign Washer-Rinsing Pump

*By Bob Brooks, WST2 Pavement
Technology Engineer*

Dan Vest, of WSDOT's Aberdeen Maintenance Facility, and his supervisor John Hagedorn have designed and built a simple and inexpensive device for improving efficiency; the portable sign washer-rinsing pump. For less than \$100 per unit, the washer pump incorporates a 12-volt direct current (12 VDC) pump attached to a 55-gallon polyethylene drum that is loaded onto the bed of a pickup truck and powered by the truck's electrical system. The drums can be filled with either a detergent solution or a rinse water solution to greatly increase the production of the sign washing operation.

At the heart of the system is a 12-volt direct current, 10-amp, diaphragm pump manufactured by the SHURflo Pump Manufacturing Company of Cypress, California, phone (562) 795-5200, model number 2088-443-144. The pump delivers 3.5 gallons per minute at a pressure of 45 pounds per square inch. The pump comprises most of the cost of building the washer unit; the Aberdeen crew paid about \$65 for the pump. The pump is bolted to the top of a 55-gallon drum and



one-half inch diameter pneumatic tool hoses are attached to the pump fittings using hose clamps. One hose is submerged in the wash or rinse water in the drum and the other hose is attached to a squeeze nozzle that controls the flow of the water. Attaching leads to the truck's 12-volt battery or electrical system provides power.

The other major component of the washer system is the 55-gallon, Act II, tight head, high density polyethylene (HDPE) drum

manufactured by the Russell-Stanley Company, phone (908) 203-9500. This is a relatively lightweight, rugged drum that's well suited to use in the washer system.

Other than the drum, pump, and hoses, the only other things needed to build the washer pump are some electrical wire, clamps for attaching to the truck's electrical system, and hose clamps. These can all be assembled in a few hours time into a working washer unit.

The Aberdeen crew places the unit in the back of a pickup truck and fills the drum with rinse water. A separate detergent solution is used for washing signs and the drum unit is used to quickly rinse the signs. This setup has allowed the crew to speed-up production and cut the overall costs associated with sign cleaning activities. At only \$100 per unit, this device can easily pay for itself in a short time. This is yet another example of the creative and innovative thinking exhibited by our WSDOT and local agency maintenance crews.

For more information, contact Dan Vest or John Hagedorn at (360) 533-9447. ▲



City of Raymond Thanks WSDOT for Role in Recent Third Street Business Loop Streetscape Project



By Jilayne Jordan, WSDOT
Southwest Region Public Information
Officer

During a recent dedication event for the Third Street Business Loop Streetscape project in the city of Raymond, Washington State Department of Transportation (WSDOT) Southwest Region Local Programs Engineer Bill Pierce, Assistant Engineer Ken Hash, and WSDOT Director of Highways and Local Programs Kathleen Davis received Raymond Community Builder Awards from Mayor Mike Runyan. The awards were given as a thank you for Bill, Ken and Kathleen's assistance in getting the Streetscape project funded and completed. Rep. Brian Hatfield, Transportation Improvement Board (TIB) Vice Chair Bill Ganley, TIB Director Steve Gorcester, Raymond

*During the
dedication,
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funding partners,
which included
WSDOT.*

Public Works Director Rebecca Chaffee, and residents of Raymond attended the dedication, which included a hot dog feed.

During the dedication, representatives from the city praised the cooperation between the project's funding partners, which included WSDOT. Rep. Hatfield also took the opportunity to remind event attendees that for every \$1 in gas taxes they pay, Pacific County gets just over \$3 dollars back in the form of funding and grants that allow projects like the Streetscape to happen.

Over the last 10 years, the Third Street business loop in Raymond had been bearing the brunt of the decline of the local timber industry, a destructive fire in the downtown area and the February 2001 earthquake, and was in dire need of a facelift. With the assistance of WSDOT Southwest Region's Local Programs Office, the city applied for and received a \$1.1 million federal Rural Economic Vitality grant. That, in combination with \$130,000 in federal Surface Transportation Program funds, \$30,000 from WSDOT, and \$178,000 from TIB, allowed the city to create an attractive downtown business loop area. ▲

SR 105 Spur:

Paving, Safety and Enhancement Projects Benefit Everyone

By Stefani Hardy, WSDOT Aberdeen Project Engineer's Office, Field Engineer

Washington State Department of Transportation (WSDOT) Aberdeen Project Engineer's Office recently administered a project that included three elements: paving, intersection improvements, and pedestrian/bike safety enhancements.

WSDOT preservation and safety programs funded the first two elements of this project. The preservation portion of this project included pavement repair, overlay, and associated work on SR 105 and SR 105 Spur between MP 29.61 and MP 34.34. The safety portion of this project included improving the T-intersection of SR 105 and SR 105 Spur by adding acceleration lanes and turn pockets, widening shoulders, and improving drainage.

The third element of this project was funded by the city of Westport through a federal enhancement grant. The purpose of this grant was to improve and/or enhance the pedestrian and bicycle safety along SR 105 Spur inside the city of Westport. This was accomplished by adding left-turn lanes at city street intersections, adding bicycle lanes to both sides of the highway, constructing sidewalks with wheelchair accessible ramps along both sides of the highway, adding illumination, improving drainage, and realigning a sharp curve, all between SR 105 Spur MP 33.66 and MP 34.34.

During the preliminary engineering phase of this project, WSDOT provided a complete design package for the city's review and concurrence, including a construction cost estimate, and was able to assist the city with right-of-way acquisition required for the improvements.

By combining these three projects into one project, WSDOT was able to obtain lower bid prices and combine our administrative duties. In fact, the city's portion of the work done by the contractor cost less than their available grant funds. This was very beneficial when some unexpected conditions arose and WSDOT was able to address the issues within the available funds. With grant funds still remaining, the city of Westport was able to further improve drainage facilities, add two blocks of new sidewalks, and construct three cement concrete crosswalks that were dyed red and stamped with a brick pattern.

The final project is functional and aesthetically pleasing. It provides a unified and continuous roadway from the Westhaven State Park to the Westport docks. These projects, constructed separately, would have taken much longer to complete, cost significantly more, and caused a longer disruption to the traveling public.

For more information contact Stefani Hardy at (360) 533-9352. ▲



Enhancement



Paving



Safety

Corridor Safety Program:



A Successful Model of Partnerships

By Matthew Enders, WSDOT
Corridor Safety Program Manager

The Corridor Safety Program works to reduce collisions on roadways using low-cost, near-term solutions through the use of partnerships with engineering, enforcement, education, and emergency medical services. The program is locally coordinated in each community, and involves interested citizens along with businesses and agencies that have a vested interest in the safety of their roadways. While the Corridor Safety Program has traditionally been on the state highway system, this concept was introduced during the fall of 2002 to county engineers and city public works directors in coordination with Brian Walsh, the WSDOT Local Traffic Services Engineer, in order to address county roadways as well.

On Wednesday, November 6, 2002, the Corridor Safety Program was presented with the Governor's Award for Public Benefit. This award was presented due to the success of the program in reducing collisions in Washington State (see graphs below). The Corridor Safety Program is jointly run by the WSDOT and the Washington Traffic Safety Commission, with partner agencies including the Washington State Patrol.

For more information about the Corridor Safety Program, contact Matthew Enders, WSDOT Corridor Safety Program Manager, at (360) 705-6907 or endersm@wsdot.wa.gov.



Top photo: Moses Lake Kickoff

Middle photo: Columbia

Gateway Kickoff

Bottom photo: Lake Stevens Kickoff



A Successful Three-Way-Partnership

By Jeff Adamson, Communications Manager, WSDOT North Central Region

"It was a hat trick! A win-win-win for us, DOT and LINK Transit." An 18-mile paving project on US 97A in Chelan County proved to be the vehicle that generated that enthusiastic evaluation from Entiat Mayor Wendell Black. "Pooling our money and our projects produced a better end result and saved a bunch of money. We're always going to fight with you because we want all those tourists to stop here and DOT wants to see traffic moving safely, but we've always managed to work out the differences. This time, though, you really did us right!"

WSDOT Project Engineer Terry Berends was equally enthusiastic about the results of the three-way partnership that not only improved the busy summer tourist corridor to Lake Chelan, but significantly upgraded transit access and pedestrian safety in Entiat. "By combining a grant-funded sidewalk project that Entiat wanted into our paving project, the bids, design costs and construction inspection costs were all reduced." The city had \$288,835 to spend for five-foot sidewalks, curbs and six-foot planter strips along the east side of US 97A between Cammack Avenue and Wisdom Street. Their final cost was only \$207,800.

Link Transit included two bus pullouts and two handicapped passenger drop-off pads into the project with similar savings. "Besides the money, the impact on traffic and the community was reduced by combining the



New sidewalks dramatically improve safety along busy US 97A in Entiat.

three projects," said Berends. "Doing all three at once meant that traffic-restricting lane closures only happened once, and a single contractor was able to coordinate all the work into a single effort."

The total \$2.46 million project came in on time and on budget. It paved the 18 miles from the Entiat River Bridge on the south end of Entiat to Lakeside Park on the south shore of Lake Chelan. In addition to the two-inch asphalt overlay, one and one-quarter mile was added to the truck-climbing lane north of the Knapps Hill tunnel. Slope stabilization and drainage improvements at the tunnel were incorporated into the project as well. "The end result was a high quality project at a lower cost to taxpayers," said Berends, "not to mention three very satisfied partners."

There was actually a fourth "silent" partner, says Berends. "Our WSDOT maintenance forces used ditch cleanings and waste material to construct the earthwork for the truck climbing lane last year and



Adding 1-1/4 miles to the truck climbing lane above the Knapps Hill tunnel on US 97A near Lake Chelan has been much appreciated by residents and vacationers alike.

we just had to add surfacing and pave it. By having the majority of the earthwork done already, the cost for adding this one and one-quarter mile of truck climbing lane only cost us \$220,000. We have received several comments from the public about how much they appreciate this extension. With maintenance looking ahead at this need and using this area as a waste site that allowed us to add this improvement to our paving project at a smaller cost, I feel this is a huge step to improving efficiency."

For more information, contact Terry Berends, WSDOT North Central Region Project Engineer, at (509) 667-2880 or berendt@wsdot.wa.gov. ▲

SR 16 Union Avenue to Pearl Street Design Recommendations Published



SR 16 Bicycle/Pedestrian Trail steering committee members actively involved in developing the trail alignment.

*By Nancy Boyd, WSDOT Olympia
Design Project Office*

During the spring of 2002, Washington State Department of Transportation's (WSDOT) Olympia Design Project Office worked with neighborhood and community representatives and local agencies in selecting a preferred trail alignment for the SR 16 Union Avenue to Pearl Street Bicycle/Pedestrian Trail Design. The committee recently released its recommendations that document a substantial segment of the SR 16 Multi-use Trail in Tacoma, WA. Trail segments will be constructed as part of several HOV freeway improvement projects planned for the SR 16 corridor. Ultimately, a continuous trail will be constructed running from Sprague Avenue to the Tacoma Narrows Bridge.

WSDOT wishes to thank the following partners for their effort

and enthusiasm in developing the proposed alignment:

- Tacoma Wheelmen's Bicycle Club
- City of Tacoma
- West End Neighborhood Association
- Oakland-Madrona Neighborhood Planning Commission
- Pierce Transit
- Tacoma Nature Center
- Tacoma Dome/Cheney Stadium
- Metro Parks
- City of University Place

For more information on the SR 16 Multi-use Trail and the Tacoma/Pierce County HOV freeway improvement program, please contact Nancy Boyd, WSDOT Project Engineer, at (360) 570-6662 or boydn@wsdot.wa.gov.



Living Longer and Better

*By W. C. Evans, LTAP Manager,
FHWA*

June used to have something to do with Federal Fitness Month (or maybe there was a Federal Fitness Day sometime in June). (I know, you are not Fed's and you do not have to worry about this.) We all make fitness and awareness of personal health somewhat a priority in our lives. I am no different, but was surprised by the findings of a health study in a news article. Health professionals nationwide developed this study.

Having been in the transportation field all of my career, I still did not realize that two of the top four items in the list would be transportation



related and lead to better health and influence our longevity. Safety rather than fitness and health are at the top of this study.

More than 60 health and longevity affecting factors were listed. I am just listing the top 20 or so.



1. Not smoking
2. Not smoking in bed
3. Wearing a seat belt
4. Avoiding driving under the influence of alcohol
5. Living in a home with a smoke detector
6. Keeping a strong network of friends
7. Exercising regularly
8. Moderating alcohol usage
9. Being careful to avoid accidents at home
10. Restricting dietary fat
11. Maintaining a healthful weight
12. Having blood pressure



checked annually

13. Obeying the speed limit
14. Controlling stress
15. Consuming enough fiber
16. Restricting cholesterol
17. Getting adequate vitamins and minerals
18. Seeing a dentist regularly
19. Restricting sodium
20. Restricting sugar
21. Getting 7 to 8 hours of sleep nightly (Hmmm...)



Here is the best part - these are the things that we chose to do - or not to do. We have control of all of these things. We can put ourselves on the positive side of each of them.



As someone once said,
"When you have your health, you have it all!"





Words from the Chair



A short story...

Pete Clarke will never forget the day they opened Uncle Charlie's will.

Charlie Clarke was one of the best-known men in the county and he was wealthy...or so it seemed. The Clarke family owned almost all of the property in the county: apartments, duplexes, single-family homes; some built at the turn of the century, some brand new. Pete knew the property would stay in the family when Charlie passed away; he just never dreamed he would be the heir.

At the reading of the will, Pete and his brothers gathered together and waited quietly as the envelope was opened. There was a hush as they all heard that Charlie had decided Pete would carry on the family responsibility to care for this property. Pete's wife waited at the door as Pete returned. "We're rich", Pete whispered to his wife. However, Pete would soon discover that the reality of his inheritance was different than his perception.

Over the course of the next few

*Over the course of
the next few weeks,
Pete learned a great
deal about Charlie
and the family
legacy.*

weeks, Pete learned a great deal about Charlie and the family legacy. Charlie liked people, and it was important to him that the family traditions were upheld. It was up to Charlie (and now Pete) to take care of all of the properties. People lived in all the properties and paid rent to Charlie.... and Charlie saw to it they got a lot for their money. Charlie hired people who were good at fixing things to help the tenants when they called. They fixed leaky faucets, repaired broken windows, replaced missing roof shingles, repaired squeaky

door hinges...in fact, they even vacuumed the carpet and changed the light bulbs. There were some things that Charlie's fixing crew could not handle and Charlie hired other people to replace roofs, paint the siding, remodel the rooms, and repair the foundations. Sometimes the house would be so bad; the residents would live in one end of the house while Charlie's crews replaced the other end.

Pete learned that Charlie liked to make people happy. He never wanted to raise the rent but he wanted everyone to think that he was doing a good job. So, Charlie made sure that whenever anyone called, his fixers were there on the spot. They were pretty creative, too, because sometimes they just were not able to fix the cause of the problem, but they did their best. Pete also found that sometimes it was difficult to predict what made people happy. Some complained when the carpet was a little dirty. Others did not mind the jack and post in the middle of the living room holding up the ceiling.

Pete also found out that on occasion, Charlie's houses and apartments were built with problems. Several years back, Pete found out that a new roof design had been used that made the construction of Charlie's houses deteriorate much faster. A few years later, Charlie's fixers were finding the same problem over and over on the houses built at that time. They knew they had a problem. It is too bad, though. Charlie's fixers tried to tell the house builders that there was a problem, but they never listened.

Charlie wanted to do a good job. A few years back, Charlie and his fixers thought that it might be a good idea if they made a list of all the properties and looked at each one carefully to see what needed to be done. Charlie then got the idea that maybe the fixers could help him come up with a way that other people could look at the houses (even though they knew nothing about fixing it) and be able to describe what needed to be done. They were even able to look at the cost to fix all the homes to Charlie's satisfaction.

Then Charlie died.

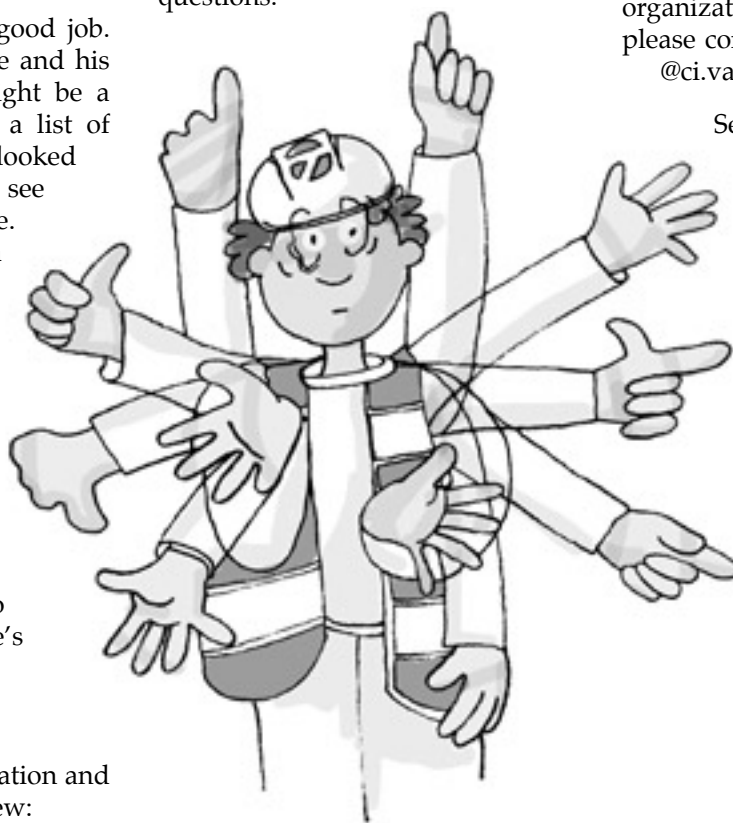
Pete took stock of his situation and made a list of what he knew:

- I cannot sell the properties.
- I must make every one capable of being lived in.
- Even though they can be lived in, some are acceptable, some are tolerable, and some are unacceptable.
- I know that there are many opinions of what is acceptable, tolerable, and unacceptable.
- I do not have enough money to

make all the unacceptable ones tolerable or acceptable.

- My source of money is the rent and no one wants the rent raised.
- The family traditions of service and affordable housing are important to me.
- I need to make out my will now so the family legacy can be carried on uninterrupted.

Pete was faced with a number of questions:



- What is an acceptable, tolerable, or unacceptable property?
- Whose apartment, duplex, house, etc. gets worked on first?
- Is enough money being spent on the family's property?
- What do I want my heirs to face when they open my will?

Well, you probably get the idea: properties are roads, rents are taxes, and Pete is the pavement manager.

Pavement managers are stewards of generally the most valuable asset managed by local agencies, the surfacing on local streets and highways. As an organization of pavement managers and others interested in pavement management, the NWPMA seeks to provide opportunities for networking and information transfer. I am looking forward to serving as chairperson of the organization this year. For NWPMA members and other interested individuals, this is your organization. If you have ideas on how the organization can better help you, please contact me at bill.whitcomb@ci.vancouver.wa.us.

See you in April at the spring conference in Tacoma.

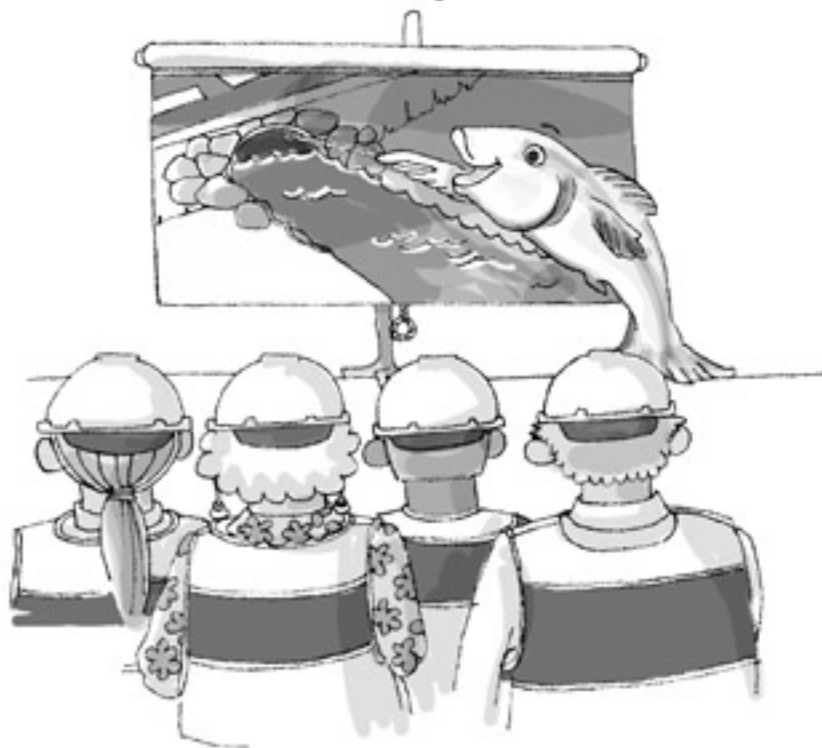
To get more information and to find out more about the organization, go to the website at <http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/PavementTechnology/NWPMA.html>.

Bill Whitcomb

Bill Whitcomb
Chairman, NWPMA
City of Vancouver Washington



Congratulations to National Awards Recipients in Washington State



*By Liana Liu,
P.E. Traffic/Safety/T2 Engineer,
FHWA Washington Division*

The Federal Highway Administration (FHWA) announced the selections for its 2002 national awards for Excellence in Highway Design on October 13, 2002. The awards were given at the annual meeting of the American Association of State Highway and Transportation Officials (AASHTO) in Anchorage, AK.

Washington State received two awards for Environmental Protection and Enhancements. The Award of Excellence for Environmental Protection and Enhancements was

given to First Creek Fish Passage, Chelan, WA, designed by Washington State Department of Transportation North Central Region. The Merit Award for Environmental Protection and Enhancements was given to Indian Creek Stormwater Facility, Olympia, WA, designed by the city of Olympia.

Washington State's I-405 Corridor Program was also recognized with a Smart Growth Award, presented at the AASHTO Annual Meeting. Washington State was one of eight nationwide recipients showcasing best practices. The competition, titled Smart Moves: Transportation Strategies for Smart Growth, was

sponsored by AASHTO in cooperation with FHWA and the U.S. Environmental Protection Agency.

Information about the First Creek Fish Passage and the Indian Creek Stormwater Facility projects can be found at <http://www.fhwa.dot.gov/eihd/2002/cat4.htm>. ▲

Census Data for Transportation Professionals

*By Jennifer Boteler, Washington
State Department of Transportation
Librarian*

In the last six months there have been several Census 2000 products and compilations released that include data important to transportation professionals.

Probably of most importance would be the designation of urbanized areas (UZAs) and urban places/clusters based on the 2000 Census. For example, four new UZAs were designated in Washington State by the 2000 Census: Clarkston, WA-Lewiston, ID; Marysville; Mount Vernon; and Wenatchee.¹ These designations have an effect on the Federal Highway Administration (FHWA) Surface Transportation Program. Most notably, there is the need to establish new Metropolitan Planning Organizations (MPOs) or affiliate with existing MPOs if one is adjacent and federal funds are available for operating assistance and block grants.²

The Census Transportation Planning Package (CTPP) is a special set of tabulations from the decennial census designed for transportation planners. The first profiles of the CTPP 2000 are available on the AASHTO website. The profiles include data for household size, vehicle availability, means of transportation to work, and travel time to work. The profiles are published for all states and counties.³

*The Census
Transportation
Planning Package
(CTPP) is a special
set of tabulations
from the decennial
census designed
for transportation
planners.*

Another census-based resource used by transportation planners is journey-to-work trends. Although a journey-to-work trends report (similar to earlier FHWA reports based on decennial censuses) has not been published, the Surface Transportation Policy Project has released demographic profiles from the 2000 Census. Data of interest to transportation professionals include commute mode, travel time to work, and number of vehicles per household. Each data point is given by state, county, place, metro area, and congressional district.⁴ There is also an article with preliminary findings in the September 2002 issue of CTPP 2000 Status Report. This article and other resources are available on the TRB Subcommittee on Census Data for Transportation Planning website.⁵

The Urban Mobility Study is an annual report produced by the Texas Transportation Institute and funded by a consortium of 10 state transportation agencies. Statistics, including Census data, are analyzed to provide information about mobility and traffic congestion on freeways and major streets in 75 cities. For instance, the Seattle-Everett area was ranked fifth in the nation for 'annual delay per peak road traveler'. Data is also given for Tacoma and Spokane.⁶

Metropolitan transportation planners strive to involve minority populations and low-income populations in developing transportation projects that fit harmoniously within their communities without sacrificing safety or mobility. Planners find the American Community Survey (ACS) data beneficial when addressing environmental justice concerns. "The ACS provides accurate, up-to-date profiles of America's communities every year. The decennial census obtains demographic, housing, social, and economic information by asking a 1-in-6 sample of households to fill out a 'long form'. Since this is done only once every 10 years, long-form information becomes out of date. Planners are reluctant to rely on it for decisions that are expensive and affect the quality of life of thousands of people. The ACS is a way to provide the data communities need every year instead of once in ten years. It is an on-going survey that the Census Bureau plans will

replace the long form in the 2010 Census.”⁷

In addition to the products already discussed, the Census Bureau has a phenomenal amount of Census products available on the Internet, on CD-ROM, DVD, and in paper form. A tool that is fun and easy to use is American Fact Finder. You can input a street address and readily find demographic information for just about any location.⁸

Using Census 2000 data, some MPOs and Regional Transportation Planning Organizations (RTPOs), such as Puget Sound Regional Council, Thurston Regional Planning Council, and Yakima Valley Conference of Governments, have produced statistical compilations for their areas.^{9, 10, 11}

Here are other preliminary findings based on Census 2000 Data from the Urban Mobility Corporation.¹²

- Can we tame sprawl? Downs, A. Innovation Briefs. 2002/03. 13(2)
- Travel habits and demographic trends at the turn of the century. Innovation Briefs. 2001/09. 12(5)
- The myth of the under-funded mass transit. Innovation Briefs. 2002/07. 13(4)
- New census data provides a reality check. Innovation Briefs. 2002/07 13(4)
- Mass transit debate continues. Innovation Briefs. 2002/11. 13(6)

Your local public or university libraries can help you obtain full text of these articles, or contact the WSDOT Library for assistance at (360) 705-7750 or library@wsdot.wa.gov.

References

- 1 U.S. Census Bureau - Census 2000 Urban and Rural Classification http://www.census.gov/geo/www/ua/ua_2k.html. Website in-

cludes Federal Register notices, urbanized area and urban place/cluster listings, definitions, maps and more.

- 2 Federal Highway Administration - Census Issues <http://www.fhwa.dot.gov/planning/census/>. Follow link for “Applying Census Data to Urbanized and Urban Areas in the FTA Planning Programs and FHWA Programs.”

Metropolitan transportation planners strive to involve minority populations and low-income populations in developing transportation projects that fit harmoniously within their communities without sacrificing safety or mobility.

- 3 AASHTO Census Transportation Planning Package (CTTP) 2000 Profile Sheets <http://transportation.org/ctpp/home/default.htm>
- 4 Surface Transportation Policy Project - Transportation Data from the 2000 Census <http://www.transact.org/report.asp?id=188>. Also available in print through NTIS. Census Journey-to-Work: What

Do We Know About How Americans Travel? Report number: FTA-MA-26-7007-02.1

- 5 Transportation Research Board - Census Data for Transportation Planning <http://www.trbcensus.com/>. Follow link on left-hand side bar for “Newsletters.”
- 6 Texas Transportation Institute - The Urban Mobility Study <http://mobility.tamu.edu/>
- 7 American Community Survey <http://www.census.gov/acs/www/>
- 8 American Fact Finder <http://factfinder.census.gov/servlet/BasicFactsServlet>
- 9 Puget Sound Regional Council <http://www.psrc.org/datapubs/census2000/index.htm>
- 10 Thurston Regional Planning Council <http://www.trpc.org/>
- 11 Yakima Valley Conference of Governments <http://www.yvcog.org/census/census2000quickfacts.htm>
- 12 Urban Mobility Corporation - Innovation Briefs Abstracts <http://www.innobriefs.com/index.html> ▲



By Roger Chappell, WST2 Technology Integration Engineer

What is a virtual world and how is it built using multidimensional data? The American Heritage Dictionary defines virtual as "existing or resulting in essence or effect, though not in actual fact or form." For the purposes of this article, my virtual world only exists in computer-defined "space."

One nice thing about using virtual worlds to model real life scenarios is that it is less expensive and less disruptive to the environments being modeled.

Whether you want to evaluate the impacts of a new super highway going through an urban center or a predictive model for flooding and emergency response, the place to practice is in a virtual world. The whole purpose for data is to help you make better decisions. There is nothing fun or glamorous about data collection, processing, and analysis; it is just part of the decision making process. You could build a new super highway through an urban center without any data to base your decisions on, but it is not a recommended practice. Just remember that neither the models nor the data are exact replications of the "real world."

Building a virtual world can be difficult at times. Data comes

Whether you want to evaluate the impacts of a new super highway going through an urban center or a predictive model for flooding and emergency response, the place to practice is in a virtual world.

from many different sources; the programs must allow you to use data that has been referenced with a variety of different coordinate systems. For example, the intersection of First Street and Main Street can be described by using a coordinate system such as latitude and longitude (in degrees, minutes, and seconds or some form of decimal degrees), a datum, or some other coordinate system. They may be 2D or 3D dimensionally referenced coordinates or described as a feature that occurred along a route at a given milepost, using an LRS (linear referencing system).

Building a Virtual World with Multidimensional Data

The location may even be described as a node in a network or a section, township and range. This location data not only describes where something is in the real world, it also places it in computer space.

Currently most GIS (Geographical Information System) users work in 2D space, but the tools and need for 3D data is constantly growing. In routing, for example, you can see where two highways intersect in 2D space, but if there is an over or under crossing, it is difficult to tell if the roadways connect.

Therefore, location data may not only help you to place your data in computer space or a GIS, it may also reveal interactions and relationships between data elements.

Most data can be described as a point, line, or polygon (area). A bridge may be a point on a map, the same bridge may be a line from bridge seat to bridge, or it may be described as the area of the bridge deck. The bridge is a complex data object, with many "attributes" describing its physical characteristics. It may also have several spatial descriptions describing where it is located in both the real world and inside a computer world.

What is a boundary in the real world? A boundary is really just a polygon that distinguishes the

Therefore, location data may not only help you to place your data in computer space or a GIS, it may also reveal interactions and relationships between data elements.

difference between types of data. Some boundaries are stable or static by nature. For example, country, state, and county boundaries are relatively static. Has the geographic landmass of North America “always” been divided the way that it is today? No, but these boundaries don’t change as frequently as those of other continents. As long as the polygon remains the same size and shape (area) and in the same spatial location, data comparisons are relatively easy. When the polygon changes, the dimension of time must be added to the data so that comparisons will be made between similar data types; the data before the change and the data that occurred after it. Some data change in a cyclic fashion, such as Congressional Districts or other census-based information, while other data change because the elements that they represent physically change. These changes, based on time events, need to be accounted for.

Another good thing to remember is that virtual worlds are fragile; formats change, an operating system becomes obsolete, and hard drives die. The second law of thermodynamics basically says that all matter goes from a higher form to a lesser form, unless acted

upon by an outside force. Unless acted upon by you (the outside force), entropy will take over and your data will deteriorate. When CDs were first introduced, it was said that the storage medium could keep your data safe for 50+ years. That may be true, but hop in your mental time machine and go back 50+ years and try to use those CDs. Unless you bring the supporting technology along with the data or migrate the data to new data structures, all you will have is an antique piece of plastic.

Another good thing to remember is that virtual worlds are fragile; formats change, operating systems become obsolete, and hard drives die.

At this point, you might ask why is this important. In 50+ years, will anyone care about the data you collect? I have done data creation from right-of-way plans to glean data for layering in a GIS. Were the right-of-way plans designed with GIS in mind? No, in fact it was difficult to extract the data I needed from the plans, but it was less expensive than sending a survey crew out to collect the data. I was lucky that the data I was interested in could still be physically collected. What will the landscape where your data is collected look like in 50+ years?

Most data today is a snapshot in time, reflecting what is taking place in your modeled environment at a given time. Some people update their data dynamically with the

most current data available, but it is still only a reflection of the current environment. In the future, data cube technology will become more available and easier to use. With data cube storage, not only will you be able to use your currently modeled data, you will also be able to see how it has changed through time. These changes in data through time are known as strata of data. These stratified layers will reveal patterns of changes such as growth management issues and changes to the physical environment. For example, current data and technology allows me to see that there have been 250 accidents at a given intersection over the last ten years. What cube-stratified data would show me is that some of the data occurred when the intersection had a lower traffic volume and was configured as a four way stop. Other data occurred when the intersection was modified with signalization, turning movements, and channelization. Eventually, the intersection is modified using a roundabout and pedestrian islands. Using current technology and data, this intersection may be identified as a high accident location; however, it is difficult to substantiate that conclusion. When analyzing cube-stratified data, hopefully you will discover that the roundabout allowed for better throughput of traffic performance while also reducing the number of accidents.

In conclusion, the better the data, the better the decisions that are made. Do you have a comprehensive data migration plan? What about Metadata (which is data about data elements or attributes)? Is your data structured for integration into future technologies? We are gathering tomorrow’s data today. Decision makers that may affect your future could use that data. Are you helping them to make the best possible decisions? ▲

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Mail: WST2/WSDOT, H&LP, P.O. Box 47390, Olympia, WA 98504-7390.

✓ Check the items you would like to order. An asterisk (*) denotes publications included in the 2002 WST2 CD Library.

- 1999 Audio Visual Catalog, T2Center
- 2002 Technology Transfer CD Library: Technical Documents
- Asphalt Pavement Repair Manuals of Practice, SHRP, 1993*
- Asset Management Primer, FHWA, 1999
- A Walkable Community is More Than Just Sidewalks, FHWA, 2000
- Bicycle & Pedestrian Case Studies: No. 7: Transportation Potential & Other Benefits of Off-Road Bicycle & Pedestrian Facilities, FHWA, 1992 No. 14: Benefits of Bicycling and Walking to Health, FHWA, 1993 No. 15: Environmental Benefits of Bicycling & Walking, FHWA, 1993
- Concrete Pavement Repair Manuals of Practice, SHRP, 1993*
- Concrete PASER Manual, University of Wisconsin, 1998
- Contracting for Professional Services in Washington State, MRSC, 1994
- Crack Seal Application, FHWA, 2001
- Data Integration Primer, FHWA, 2001
- Dust Control on Low Volume Roads, FHWA, 2001
- Dust Palliative Selection and Application Guide, USFS, 1992*
- Engineer's Pothole Repair Guide, US Army Corps of Engineers, CRREL, 1984
- Family Emergency Preparedness Plan, American Red Cross, et al., 1998

- Field Guide for Unpaved Rural Roads, Wyoming T2 Center, 1997
- Fish Passage Through Culverts, FHWA, USDA, 1998
- General Field Reference Guide (Pocket Size), 2002
- Geotextile Selection and Installation Manual for Rural Unpaved Roads, FHWA - 1989
- Getting People Walking: Municipal Strategies to Increase Pedestrian Travel, Rhys Roth, Energy Outreach Center
- Gravel Roads – Maintenance and Design Manual, SD LTAP, 2000*
- A Guide to the Federal-Aid Highway Emergency Relief Program, USDOT, June 1995
- Local Agency Pavement Management Application Guide, WST2 Center, 1997*
- A Guide for Local Agency Pavement Managers, NWT2 Center, 1994*
- A Guide for Erecting Mailboxes on Highways, AASHTO, 1984
- Highway / Utility Guide, FHWA 1993
- Improving Conditions for Bicycling and Walking, FHWA, 1998
- Improving Highway Safety at Bridges on Local Roads and Streets, FHWA, 1998
- International State-of-the-Art Colloquium on Low-Temperature Asphalt Pavement Cracking, CRREL, 1991
- Local Agency Safety Management System, WSDOT, 1998, Reprinted 2000*

- Local Low Volume Roads and Streets, ASCE, 1992
- Maintenance of Aggregate and Earth Roads, WST2 Center (1994 reprint)
- Maintenance of Signs & Sign Supports for Local Roads and Streets, FHWA, 2001
- Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance Personnel, FHWA, 1996*
- New Generation of Snow and Ice Control, FHWA
- Pavement Surface Condition Field Rating Manual for Asphalt Pavement, NWPMA, WSDOT, 1999*
- Pedestrian Facilities Guidebook, WSDOT, 1997
- Planning & Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, TRB
- Pothole Primer – A Public Administrator's Guide, CRREL, 1989
- Recommendations to Reduce Pedestrian Collisions, WSDOT, December 1999
- Redevelopment for Livable Communities, Rhys Roth, Energy Outreach Center, 1995
- Signposts for Snow Trails, USDA, 1998
- State-of-the-Art Survey of Flexible Pavement Crack Sealing Procedures in the United States, CRREL, 1992
- Streetwise, A Simplified Local Agency Pavement Management System, WSDOT, 2000*
- Superpave System – New Tools for Designing and Building More Durable Asphalt Pavements, FHWA
- Traffic Calming: A Guide to Street Sharing, Michael J. Wallwork, PE, 1993
- Trail Construction & Maintenance Notebook, USDA, 2000
- Utility Cuts in Paved Roads, Field Guide, FHWA, 1997
- W-Beam Guardrail Repair and Maintenance, FHWA, 1996
- Washington Bicycle Map, WSDOT, 2001
- Wetland Trail Design and Construction, USDA, 2001
- Wildlife Habitat Connectivity Across European Highways, FHWA, 2002

Workbooks and Handouts from WST2 Center Workshops:

- Access Management, Location and Design, FHWA (NHI), 2001
- Application of Geographic Information Systems for Transportation, FHWA (NHI), 1999
- Construction Documentation: Construction Training Manual for Local Agencies, WSDOT, 2003
- Design, Construction and Maintenance of Highway Safety Features and Appurtenances, FHWA (NHI), 1997 (update included)
- Handbook for Walkable Communities, by Dan Burden and Michael Wallwork
- Highway Maintenance Welding Techniques and Applications, Tom Cook, Cornell Local Roads Program, 1995
- Pavement Maintenance Effectiveness/ Innovative Materials Workshop Participant's Handbook

Videotapes:

- Driving Modern Roundabouts, City of Lacey, City of Olympia and WSDOT, 2002
- Walkable Communities: Designing for Pedestrians, Dan Burden, \$50/set of 4 videotapes

CD ROM:

- Gravel Roads: Maintenance and Design Manual, SD LTAP, 2000*
- Intelligent Transportation Systems Awareness, FHWA, 1999
- Pedestrian/Bicycle Crash Analysis Tool, FHWA, 1999
- Pedestrian/Bicycle Safety Resource Set, FHWA, 2000
- Pavement Preservation: State of the Practice, FHWA, July 2000
- Rockfall Catchment Area Design Guide, ODOT, 2002*
- Technology Transfer CD Library Technical Documents, 2002

Non-Credit Self-Study

Guides:

These non-credit WSDOT self-study guides may be obtained from the WST2 Center. An invoice will be sent with the books.

Basic Surveying, \$20

Advanced Surveying (metric), \$20

Contract Plans Reading, \$25

Technical Mathematics I, \$20

Technical Mathematics II, \$20

Basic Metric System, \$20

Computer Programs

The following computer program may be downloaded from the Internet at: www.wsdot.wa.gov/fossc/mats/Apps/EPG.htm:

Everseries Pavement Analysis

Programs: This series of programs contains three independent modules:

1. Evercalc 5.0 – A FWD Pavement Moduli Backcalculation Program
2. Everstress 5.0 – A Layered Elastic Analysis Program
3. Everpave 5.0 – A Flexible Pavement Overlay Design Program

Important: These programs are updated regularly. Please send your e-mail address to sivanen@wsdot.wa.gov to be included in the mailing list for updates.

FWD Area Program - This program is useful in calculating Normalized Deflections Area Value, and Subgrade Moduli from FWD Data. The program is available for download at www.wsdot.wa.gov/fossc/mats/pavement/fwd.htm

Bridge

- WSDOT Highways & Local Programs www.wsdot.wa.gov/TA/Operations/BRIDGE/BRIDGEHP.HTM

Environmental

- Environmental Procedures Manual (M31-11) www.wsdot.wa.gov/eesc/environmental/programs/regcomp/ProceduresManual/start.pdf
- Regional Road Maintenance Endangered Species Act Program Guidelines www.metrokc.gov/roadcon/bmp/pdfguide.htm
- National Marine Fisheries Service Species Listings & Info www.nwr.noaa.gov/
- U.S. Fish and Wildlife Service Species Listings & Info <http://endangered.fws.gov/>
- Washington State DNR's Natural Heritage Program Home Page www.wa.gov/dnr/htdocs/fr/nhp/refdesk/fsrefix.htm
- FHWA's Environmental Home Page www.fhwa.dot.gov/environment/index.htm

Highways & Local Programs List Serves

- Local Agency Guidelines (LAG) Manual <http://lists.wsdot.wa.gov/guest/RemoteListSummary/LAGG>
- Traffic and Safety Management http://www.t2sms-l@lists.wsdot.wa.gov/guest/RemoteListSummary/T2SMS_L
- Pavement Management http://lists.wsdot.wa.gov/guest/RemoteListSummary/T2PAVE_L
- WST2 Newsletter http://lists.wsdot.wa.gov/guest/RemoteListSummary/T2News_L
- WST2 Training http://lists.wsdot.wa.gov/guest/RemoteListSummary/T2TRNG_L

Infrastructure Management and GIS/GPS

The site below has been established to promote interagency data exchange and resources sharing between local governmental agencies.

www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/InfrastructureTechnology/InfThp.html

Legal Search

- Search RCWs and WACs
<http://search.leg.wa.gov/pub/textsearch/default.asp>
- City Streets as part of State Highways
www.wsdot.wa.gov/TA/Operations\LAG\CityStreets.html

Local Agency Guidelines (LAG) Manual

<http://www.wsdot.wa.gov/TA/Operations/LAG/LAGHP.htm>

Pavement Management

- Pavement Publications & NWPMA Links
<http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/PavementTechnology>
- NWPMA - North West Pavement Management Association
www.wsdot.wa.gov/ta/T2Center/Mgt.Systems/PavementTechnology/nwpma.html
- Asphalt Institute
www.asphaltinstitute.org/
- National Asphalt Pavement Association
www.hotmix.org/
- Pavement (A Web Site for Managing Pavements)
www.mincad.com.au/pavenet
- SuperPave Information
www.utexas.edu/research/superpave

Project Development

- Federal Aid Progress Billing Form
<http://www.wsdot.wa.gov/TA/ProgMgt/Projectinfo/BILLFORM.XLS>
- State Funded Progress Billing Form
<http://www.wsdot.wa.gov/TA/ProgMgt/Projectinfo/BILLFORMSTATE.xls>
- STIP (State Transportation Improvement Program)
<http://www.wsdot.wa.gov/TA/ProgMgt/STIP/STIPHP.htm>
- TIP (Local Agency 6-Year Transportation Improvement Program)
<http://www.wsdot.wa.gov/TA/ProgMgt/STIP/TIP.html>

Research

- WSDOT Research Office
<http://www.wsdot.wa.gov/ppsc/research>
- Looking for a Transportation Research Publication?
www.nas.edu/trb/index.html
- Municipal Research and Services Center of Washington
www.mrsc.org

Traffic & Safety

- Safety Management Publications & Information
<http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/SafetyTechnology/>
- WSDOT Traffic Data Office
<http://www.wsdot.wa.gov/mapsdata/tdo/>
- Washington State Patrol
www.wa.gov/wsp/wsphome.htm
- Washington Traffic Safety Commission
www.wa.gov/wtsc
- National Highway Traffic Safety Administration
www.nhtsa.dot.gov
- American Traffic Safety Services Association
www.atssa.com
- Municipal Research and Services Center of Washington
www.mrsc.org
- Transportation Research Board
www.nas.edu/trb/index.html

Training

- WST2 Classes & LAG Training
<http://www.wsdot.wa.gov/TA/T2Center/Training/>
- WST2 Class Registration
<http://www.wsdot.wa.gov/TA/T2Center/t2hp.html>
- County Road Administration Board
<http://www.crab.wa.gov/>
- American Public Works Association
www.apwa.net/education
- Transportation Partnership in Engineering Education Development (TRANSPED)
<http://www.engr.washington.edu/epp>

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Roger Arms (509) 577-1780,
armsr@wsdot.wa.gov
- Southwest Region (Vancouver)
Bill Pierce (360) 905-2215,
pierceb@wsdot.wa.gov

Other Online Resources

- Bicycle maps and other information
<http://www.wsdot.wa.gov/TA/PAandI/PAIHP.html>
- Pedestrian information
<http://www.wsdot.wa.gov/TA/PAandI/PAIHP.html>
- Rural Partnerships and scenic byways information
<http://www.wsdot.wa.gov/TA/PAandI/PAIHP.html>
- Better Mousetraps
<http://www.wsdot.wa.gov/ta/T2Center/Mousetraps/>
- Retired Professional Program
<http://www.wsdot.wa.gov/TA/T2Center/Retired.htm>
- Student Referral Program
<http://www.wsdot.wa.gov/TA/T2Center/StudentReferral/>
- LTAP (Local Technical Assistance Program) Clearing House
www.ltapt2.org
- Institute of Transportation Engineers
www.ite.org
- Washington State Counties
<http://access.wa.gov/government/awco.asp>
- Washington State Cities and Towns
<http://access.wa.gov/government/awcity.asp>
- Governor's Office of Indian Affairs
<http://www.wa.gov/goia/index.html>
- Southwest Interagency Coop - Grounds Equipment Maintenance (GEM)
www.gematwork.org



*Laurel Gray, WST2
Training Program
Coordinator*

Washington State T2 Center

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<http://www.wsdot.wa.gov/TA/T2Center/Training>

To register for a class in this section, use the contact listed above.

The class fees shown apply to both public and private sector students. Classes marked with an asterisk (*) are part of the Road and Street Management Training Program and fulfill a portion of the core requirements needed for the Certificate of Achievement in Road Management. See the article about this program in this issue.

Registrations are being accepted for all of the following T2 classes.

Environmental Overview for Local Agencies (LAG Program)

March 5, Vancouver; March 12, Walla Walla; March 19, Colville; March 26, Tumwater; April 9, Seattle; April 16, Port Angeles. Free. This course will give a basic understanding of environmental procedures and documentation, when they apply, what they are, and how to properly fill out the paperwork. Also covered will be Informal and Formal Consultation, Memorandums of Agreement for adverse cultural/historical effects, Programmatic Section 106 Exemptions, Tribal Section 106 Relations and Traditional Cultural Properties, 4(f) Evaluations, Environmental Assessments, and Environmental Impact Statements. This course is for local agency staff or consultants who are responsible for environmental procedures and documentation of projects.

Construction Documentation (LAG Program)

March 11, Spokane; March 12, Moses Lake; March 13, Yakima; April 8, Shoreline; April 9, Seattle. Free. All Northwest Region agencies should call Dave Engle at (206) 440-4733 to register. This course is designed for construction inspectors and those that assist them. The course will provide an overview of the documentation required to ensure compliance with federal regulations in the administration of contracts funded by FHWA and in accordance with the Standard Specifications for Road and Bridges. Regional Local Programs staff will be in attendance to answer questions.

Contract Specification Writing (LAG Program)

March 20, Lacey; April 22, Richland; May 1, Kent; September 30, Spokane; November 6, Wenatchee; December 9, Everett. \$50. Instructor: Steve Boesel. This course will provide guidance and methods for writing consistently clear, concise, complete, and well formatted contract special provisions. It will provide attendees with a thought process that can be used when writing or reviewing contract specifications to ensure the greatest possibility for a successful bid and a successful construction project. This course is for persons involved in the writing, reviewing, or enforcing of contract specifications.

Pavement Condition Rating*

May 6-7, Ellensburg; September 9-10, Tacoma. \$45. Instructor: Bob Brooks. Participants will learn to rate any of the pavements commonly found in Washington. The rating values obtained using the definitions and methods learned in this course should compare favorably with those obtained and used in the Washington State Pavement Management System. Each participant should be able to perform a pavement condition survey with reasonable objectivity.

Cultural Resources Workshop

May 6-9, The Dalles, Oregon. \$325. This class provides an exceptional opportunity to work with the region's most qualified instructors in cultural resources. Sessions take place at the Gorge Discovery Center and Maryhill Museum. There will be discussions on Native American perspective on cultural resources, state archaeology, prehistory of Washington, Native American ethnobotany, prehistoric stone artifacts, rare plants, logging in the northwest, the historic Columbia River Highway, and federal and state cultural resource regulations and how they apply to your agency. Highlights will be an evening dinner and discussion with a demonstration of flintknapping and a field trip where participants will see ancient petroglyphs and will learn how to "read" the landscape and recognize the probable cultural resources located at the site. This course is offered twice yearly in the spring and fall.

Basics of a Good Gravel Road*

May 6, Okanogan; May 8, Bellingham; May 13, Tacoma; May 15, Port Orchard. \$35. Instructor: Bill Heiden. This is a basic road maintenance class. All major problems of unpaved gravel roads will be addressed: washboarding (corrugation), traffic patterns, rutting, surface drainage, dust control, surface material, and roadside obstruction. Techniques will be discussed that will help you to reduce unpaved road maintenance expenditures to 40 percent or less of current expenditures in three to five years.

Anatomy of Grant: Grantwriting

August 13-14, Everett; September 23-24, Port Orchard; October 21-22, Moses Lake; November 4-5, Richland. \$150. Instructor: Sharon Bridwell. In this two-day workshop you'll learn practical steps to take toward grantwriting and how to approach the right funders for the dollars you need. The class will discuss writing three types of grants: federal, state, and foundations.

Design and Construction of Concrete Pavements*

May 20, Everett; October 28, Spokane. Free. Instructor: Jim Powell, American Concrete Pavement Association. The course will cover the key considerations related to design, construction, and materials for concrete streets and local roads. Topics covered will include thickness design, joint layout, construction inspection, and materials quality, proportioning, and performance. Special emphasis will be placed on ultra-thin whitetopping, a relatively new technique for overlaying urban streets, rural roads, parking areas, intersections, and light duty airports.

Preservation of Asphalt Pavements*

October 7, Tacoma; October 9, Spokane. \$100. Instructor: John Duval, Asphalt Institute. This course intends to familiarize attendees with the basic principles involved in the preservation of asphalt pavements. The workshop will introduce the concepts of preventive maintenance, the benefits and challenges of implementing a preventive maintenance program, and various techniques for prolonging the life of asphalt pavements. Emphasis will be on the successful planning and implementation of maintenance activities over a pavement's life rather than conducting "reactive" repairs on a "worst-first" basis. Topics will include the typical pavement lifecycle, recognizing pavement distresses, recognizing appropriate candidates for pavement preservation, and selection and execution of appropriate preventive maintenance methods. Extra attention will be given to the use of Thin Hot-Mix Asphalt Overlays as a pavement preservation technique.

Principles of Construction of Asphalt Pavements*

April 15, Tacoma; April 17, Spokane. \$100. Instructor: John Duval, Asphalt Institute. This one-day course intends to familiarize attendees with the basic principles involved in hot-mix pavement construction. There will be an emphasis on the general understanding of hot-mix materials, production, placement, and compaction operations.

Writing Skills*

November 5-6, Tacoma. \$110. Instructor: Jordon Peabody. This workshop is designed to reduce the confusion caused by the poorly written word. Anyone who must write on the job (but is not a writing pro) will find the training both pleasant and helpful. Writing techniques apply to letters, manuals, speeches, memos, newsletters, e-mail, proposals, reports, bulletins, and minutes.

Advanced Biological Assessment Preparation*

October 16, Lacey. \$35. Instructor: Marion Carey. Topics include biological assessment content, information analysis, making appropriate effect determinations, and common problems found in biological assessments. It will also cover conducting Essential Fish Habitat consultations. Students will come away with an understanding of how to complete the contents of the biological assessment, such as how to define the action area, and how to make and document effect determinations. Prerequisite: Introduction to ESA and Biological Assessments, or an understanding of the ESA and some experience writing biological assessments.

Bridge Condition Inspection Update

April 8-9, Spokane. Free. This course will provide information on the inspection manual and updates, laptop bridge inspections, load ratings and permitting, and other important bridge inspection issues.

Introduction of GPS Mapping Grade Equipment

\$325. This is a special request class. Four to six students per session. Instructor: Max Schade. This is an introductory course on mapping grade GPS equipment and is taught by a Trimble-certified instructor. It is designed to provide basic knowledge and skills in the use of GPS technology in mission planning, data gathering, and data processing. The training will enable field operation personnel to use new methods and Trimble mapping grade equipment as well as understand problems encountered when using the GPS satellite constellation.

Local Agency Guidelines (LAG) Training

Unless otherwise stated, the courses in the LAG program are free.

- Appraisal Review Workshop: LAG Manual Chapter 25. This is a new course that has been added to the LAG program. Two sessions will be held on the west side, one session on the east side. Jim Salter, WSDOT Real Estate Office, instructing. February / April.
- Construction Documentation: LAG Manual Chapters 51, 52, and 53. For 2003 schedule, see page 58.
- Consultants: LAG Manual Chapter 31. Training is in development by University of Washington and will be available in winter 2003. There will be a fee; however, it is undetermined at this time.
- DBE/EEO/OJT: LAG Manual Chapters 26 and 27. This class will provide local agencies with a basic understanding of the rules and procedures on Disadvantaged Business Enterprise (DBE), Equal Employment Opportunity (EEO), and On-the-Job Training (OJT) for federally funded projects. There are no sessions scheduled at this time.
- Contract Specification Writing: LAG Manual Chapters 42-46. Six sessions scheduled for 2003. See page 58 for dates.
- Emergency Relief Programs: LAG Manual Chapter 33. Curriculum is expected to be complete by winter 2003. The course covers instruction on procedures applicable to emergency projects funded by the Emergency Relief Program on federal-aid highways, and by the Federal Emergency Management Agency disaster assistance for projects not on federal-aid highways.
- Enhancement Program: Training for this course will take place after the new Federal Act is in place.
- Environmental/Introduction: LAG Manual Chapter 24. This includes Section 106 Process. Eight classes to be held in spring 2003 on east and west side. The title of the class will be "Environmental Overview for Local Agencies." See page 58 for dates. John Heinley, of Highways and Local Programs, instructing.
- Funding Workshop: LAG Manual Chapters 12, 21, 22, and 23. Includes agreements and supplements, prospectus, progress billings.
- Right of Way Procedures Workshop: LAG Manual Chapter 25 and the Federal Perspective. More classes to be scheduled in spring 2003.
- LAG Manual Overview: This course will give a basic overview of the Local Agency Guidelines Manual and the latest revisions. Two or more classes to be held spring 2003, east and west side.

There will be many classes scheduled in the next few months. For those dates, check the WST2 training web page. It is important that you tell us if you have an interest in any of the courses listed above by logging on to our web site at <http://www.wsdot.wa.gov/TA/T2Center/T2hp.htm> and accessing the on-line request

list. Click on "WST2 On-Line Request," fill out the form, and send. Individual classes will be developed in response to the request lists.

A new course, Change Order Procedures (LAG Chapter 52), is in development and is planning to be offered as an on-line training course. If you are interested in this course, please add your name to the request list.

If you have questions about the LAG Program, contact Ron Pate at (360) 705-7383 or Laurel Gray at (360) 705-7355.

The Endangered Species Act 4(d) Training Program

The Regional Road Maintenance ESA 4(d) training program has been underway since March of 2002. Classes have been scheduled and agencies that have committed to the Regional Road Maintenance Program (RRMP) Guidelines and have submitted a "Part 3 Application" have been given priority for spots in the classes. There are classes available for anyone requesting this training program that may be looking to expand their roadway maintenance with this training program.

The Part 3 Application, which is a commitment to ten program elements (of which the training program is Element #4), can be obtained from the following web site: <http://www.metrokc.gov/roadcon/bmp/pdfguide.htm> or by contacting Janine Johanson at METRO KC (206) 205-7101.

As of November 2002, over 700 registrants have taken the 22 Regional Road Maintenance ESA Training Program offerings that have been scheduled since March 2002. There have been ten Track 2 courses with 279 participants, eleven Track 3 courses with 411 participants, and one Track 4 course with 21 participants. There are classes scheduled through May of 2003, with future training dates and locations to be added to the online registration site in 2003. See below for currently scheduled classes. Class dates are tentative.

The University of Washington's Transportation Professional Development Program (TRANSPEED) is coordinating and presenting the training program. The current series of training tracks are described here, including tuition rates. For program information or course registration, please contact Julie Smith at (206) 5435539 or by e-mail: jsmith@engr.washington.edu. Those interested may also find program updates, information, and registration at: <http://www.engr.washington.edu/~uw-epp/esa/reginfo>.

Four ESA Training Tracks

The ESA Training Plan has been grouped into four separate tracks: (1) briefing for regional level decision makers; (2) a training course addressing maintenance design and technical staff procedures involved in roadway maintenance activities; (3) a training course addressing field crew practices involved in roadway maintenance activities; and (4) a course to train agency level trainers in training skills applicable to the ESA training program. These trainers are selected by their agencies for this training after completion of track 2 and 3. Track 4, the trainer training track, will teach individuals instructional skills and techniques in a classroom, and field demonstrations to be utilized in teaching the program and BMP installations.

- **Track 1: Briefing for Regional Decision Makers**
2 hours. No fee. An overview of the ESA program for regional level management and administration. This is a stand-alone training class and not part of the required training program and is offered by members of the Regional Road Maintenance Forum. Call Roy Harris or Gerry Crum at (425) 257-8800 for information. Information may also be obtained from the web site or by calling Janine Johanson at METRO KC (206) 205-7101.
- **Track 2: Introduction, Design and BMP's, Monitoring, and Environmental Roles for Technical and Scientific Staff**
March 11-12, Seattle. \$250 per person. 1.4 CEUs. This course is a combination of the various procedures for technical, professional and environmental staff, supervisors and leads involved in maintenance activities. The track is an overview addressing: introduction to the Guidelines, design, habitat, ten program elements and maintenance BMPs to meet ESA requirements.
- **Track 3: Introduction and Outcome-based Road Maintenance**
March 4, Pierce County; March 18, Seattle, March 20, King County; March 25, Pierce County; March 27, Seattle; April 8, Skagit County; April 10, Lake Forest Park. \$160 per person. 0.7 CEUs. This course is a combination of the various procedures for field crews and leads involved in maintenance activities. The track is an overview addressing: introduction to the Guidelines, design, habitat, environmental roles, ten program elements and implementation of maintenance BMPs to meet ESA requirements.
- **Track 4: Train-the Trainer for the Regional Maintenance Program**
March 4-5, April 16-17, all Renton. \$270. 1.4 CEUs. For agency-selected ESA trainers. This is the training track to train skills and techniques, evaluate, prepare, and certify candidates to teach the RRMP class room (Tracks 2 and 3) and field demonstrations for BMP installations.

Expanding Environmentally Sound Roadway Maintenance Training

While this training program has been and is focused on the ESA issues related to fisheries in the Puget Sound Region, the procedures developed by the team of state, local, and university experts outline good management practices applicable in any area seeking a consistent environmentally sound roadway maintenance program. The benefit of these

courses is that attendees are learning the applications while working in teams with peers to develop routine maintenance techniques to evaluate the site, design, and select BMPs; and to recognize site conditions to help implement maintenance BMPs in a short, timesaving workshop environment.

TRANSPEED University of Washington

Contact: Christy Pack
(206) 543-5539, fax (206) 543-2352
<http://www.engr.washington.edu/~uw-epp/>

To register for a class in this section, use the contact listed above.

The prices in this section are for local agency / non-local agency.

Advanced Highway Capacity 2000

March 4-6, Seattle. \$420/\$620.

Technical Communication for Transportation Professionals

March 10-11, Seattle; May 19-20, Lacey. \$320/\$520.

Traffic Engineering Operations-Revised Course

March 19-21, Seattle; June 16-18, Lacey. \$320/\$520.

Basic Roadway Geometric Design

March 24-26, Seattle. \$320/\$520.

Legal Liability for Transportation Professionals

April 1-2, Seattle. \$270/\$450.

Roundabout Design Concepts and Guidelines

April 16-18, Seattle. \$520 (no subsidy)

Techniques for Pavement Rehabilitation

April 23-25, Lacey. \$295/\$495.

Managing Scope, Schedule and Budget

April 28-30, Seattle. \$685/\$885.

Manual on Uniform Traffic Control Devices 2000

May 19-21, Lacey. \$320/\$520.

Developing Contract Working Days

June 3, Moses Lake. \$275/\$375.

Work Zone Traffic Control Plan (TCP) Design

June 25-27, Seattle. \$370/\$570.

Engineering Professional Programs (EPP) University of Washington

Contact: Emily West
(206) 543-5539, fax (206) 543-2352
<http://www.engr.washington.edu/~uw-epp/>

To register for a class in this category use the contact listed above.

Cold Regions Engineering Short Course

May 15-19, August 7-11; October 30-November 3, all Seattle.

\$1,295 by December 26/\$1,355 thereafter.

Fleet and Shop Management Workshops

- One workshop: \$349
- Two workshops: \$640
- Three workshops: \$840

Alternative Fuels and Advanced Technologies

Thursday, March 27, Seattle.

Vehicle Fleet Management

Friday, March 28, Seattle.

Effective Shop Management

Saturday, March 29, Seattle.

Professional Engineering Practice Liaison (PEPL) University of Washington

Contact Stephanie Storm
(206) 543-5539, fax (206) 543-2352
<http://www.engr.washington.edu/~uw-epp/>

To register for a class in this category use the contact listed above.

Prices are for early/late registration.

Mentoring and Coaching Workshop - New

March 11, Seattle. \$310/\$345.

How to Improve Stormwater Management Using Low Impact Development Practices

April 9-10, Seattle. \$475/\$510.

Quaternary and Engineering Geology in the Puget Sound Lowlands

May 1-2, Seattle. \$475/\$510.

Infiltration Facilities for Stormwater Quality Control

May 14-15, Seattle. \$475/\$510

Biological and Ecological Assessment and Monitoring - New

June 4-5, Seattle. \$475/\$510

Effective Project Negotiation Skills

March 12, Seattle. \$310/\$345

Associated General Contractors of Washington

Contact Mary Beggs
(206) 284-4500, fax (206) 284-4595
<http://www.agcwa.com>

To register for a class in this category use the contact listed above.

Construction Site Erosion and Sediment Control Certification

These WSDOT approved classes are presented by the AGC and available on the following dates: March 4-5, Wenatchee; March 19-20, Tacoma; April 3-4, Bellingham; April 17-18, Shoreline; May 7-8, Chehalis/Shelton; May 21-22, Renton; June 24-28, Olympia.

- Recertification requires attendance on Day 1 only, successfully completing exam, and proof of previous WSDOT certification. Recertification cost is \$150. You can check your certification with the on-line database as proof of certification.
- Certification training has been changed from a full two days to one and one-half days. Initial certification is \$250.
- Certification requires successfully completing end of course exam.

Road Builders' Clinic

March 4-6, Coeur D'Alene, Idaho. Contact Kelly Newell at Washington State University 1-800-942-4978 for information or registration.

Vehicle Maintenance Management Conference

March 24-27, Seattle. Hosted by the University of Washington. For information see the website at <http://www.engr.washington.edu/~uw-epp/>.

Society for Ecological Restoration 2003 Regional Conference

March 24-28, Oregon Convention Center, Portland, Oregon. For information contact the University of Washington Engineering Professional Programs at (206) 543-5539.

Partners in Emergency Preparedness Conference

April 2-3, Doubletree Inn, Bellevue. This conference is for government emergency managers, police and fire personnel, and communications staff. Registration opens February 17. For more information contact Roger Hieb at (253) 512-7042.

Community Impact Assessment – Transportation Workshop

April 8-10, Spokane. For information see the website at <http://www.engr.washington.edu/epp/cia>.

APWA 2003 Spring Conference

April 8-11, Semi-Ah-Moo Resort (1-800-770-7992 for reservations), Blaine, Washington. Sponsored by City of Bellingham.

Northwest Pavement Management Association Conference

Spring: April 15-16, Tacoma

Fall: October 21-23, Vancouver

These dates are tentative. Contact Bob Brooks at WSDOT for information (360) 705-7352.

12th Northwest On-site Wastewater Treatment Short Course and Equipment Exhibition

September 22-23, Seattle. For information see the website at <http://www.engr.washington.edu/epp/wwt>.

Road and Street Maintenance Supervisors' School

East: September 30-October 2, Spokane Valley

West: December 2-4, Tacoma

Contact Kelly Newell at Washington State University for information 1-800-942-4978.



Well...It Finally Happened!

For all you who have been waiting, the wait is over! Thanks to Jay Christianson, WSDOT, for forwarding this photo he received via e-mail. He says its was identified as a small town outside of Denver, Colorado.



Sign of the Times

Do you have a humorous traffic sign to share? Send us a print or e-mail a digital image (preferably a 300 dpi, 1000x1500 dpi jpeg or tiff) and we will add it to our collection for publishing. Please provide your name, title, agency or company, and a short description of where and when you saw the sign. We want to give you credit for your participation.

You can e-mail the image to SundeD@wsdot.wa.gov

Or mail the photo to:
"Sign of the Times"

**WST2 Center
PO Box 47390**

Please don't send your original photo. Although we will do our best to return the photo, we can't guarantee it.

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